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ABSTRACT

In this set of five booklets on electricity, primary grade students learn how to make simple circuits, make a circuit stay together, add things to a circuit, make and use switches, and fix a circuit. The major emphasis in all Unified Sciences and Mathematics for Elementary Schools (USMES) units is on open-ended, long-range investigations of real problems. In most instances students learn through observing results of their own and their classmates' experiments. However, students may recognize the need for certain facts and/or skills during their investigations. Although some children prefer to work things out for themselves, others may ask for help. USMES "How To Sets" are designed to provide such assistance. Each booklet in a set contains several examples of children using a skill being taught, each example emphasizing a different aspect of the skill or a potential pitfall. Cover pages summarize what is being taught by illustrating the general problem and solution. There is no sequence to the sets (or booklets within sets) and they should not be used out of the context of childrens' open investigation of a practical problem. (Author/JN)

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HOW TO SET

USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS

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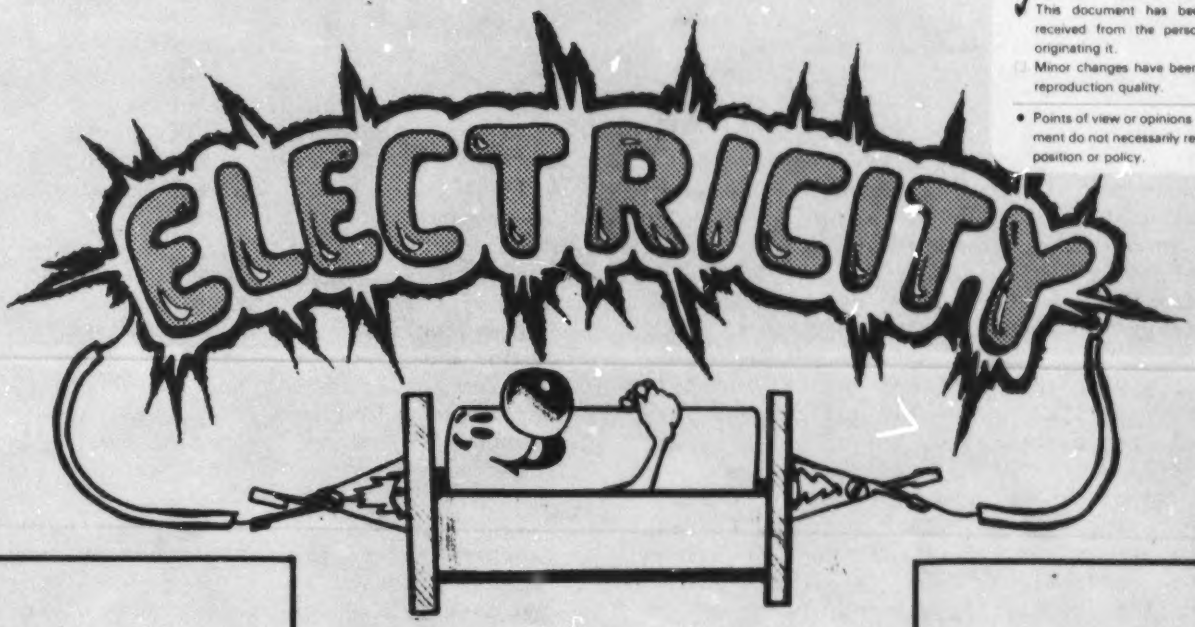

MAKE SIMPLE CIRCUITS

IN THIS SET STUDENTS WILL FIND OUT HOW TO...

MAKE A CIRCUIT STAY TOGETHER

ADD THINGS TO A CIRCUIT

MAKE AND USE SWITCHES

FIX A CIRCUIT

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WHAT IS USMES?

USMES challenges students to solve real problems within their school and community. Children tackle problems like a busy or unsafe intersection near their school, classroom furniture that doesn't fit them, or playgrounds that are crowded or uninteresting. These problems have immediate and practical impact on students. They have no established, correct solutions--students take or recommend action based upon whatever data they collect and analyze. Furthermore, the children themselves, not the teacher, direct the problem-solving process.

Solving real problems is interdisciplinary: skills, processes, and concepts from science, mathematics, social science, and language arts all play a part. For example, students conduct opinion surveys, build measuring devices, write letters, and make and use graphs. They also make decisions, work productively in small groups, and develop and clarify values.

The USMES curriculum is organized into twenty-six problems, or units, that have been developed in the classroom by teachers and students in a wide variety of schools. Most units can be used in grades K-8 although the level at which students approach a problem and develop a solution will vary according to age, ability, and interest.

RESOURCES FOR AN USMES PROGRAM

In addition to the USMES "How To" Series, there are--

The USMES Guide: This book describes the USMES project, real problem solving, classroom strategies, the Design Lab, the units, and the support materials as well as ways that USMES helps students learn basic skills.

Teacher Resource Books (one per unit): Each of these guides to using USMES units describes a broad problem, explains how students might narrow that problem to meet their particular needs, recommends classroom strategies, and presents logs from teachers whose classes have worked on the unit.

Design Lab Manual: This guide helps teachers and administrators set up, run, and use a Design Lab--a place with tools and materials where students can build things they need for their work on USMES units. A Design Lab may be a corner of a classroom, a portable cart, or a separate room.

Background Papers: These papers, correlated with the "How To" Series, provide teachers with information and hints that do not appear in the student materials.

Curriculum Correlation Guide: By correlating the twenty-six USMES units with other curriculum materials, this book helps teachers integrate USMES with other school activities and lessons.

The "How To" Series is a resource developed by the USMES project. Earle L. Lomon, Project Director; Betty M. Beck, Associate Director for Development; Thomas E. Brown, Associate Director for Utilization Studies; Quinton E. Baker, Associate Director for Administration.

This material is based upon research supported by the National Science Foundation under Grant No. SED69-01071. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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Complete USMES Library ISBN 0-89292-033-5
Beginning "How To" Series ISBN 0-89292-029-7

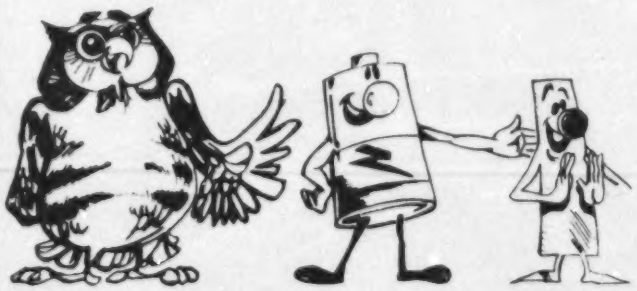
THE USMES BEGINNING "HOW TO" SERIES

USMES and Skills

USMES students often see a need to learn new skills to help them get a problem-solving job done. Children seeking to improve a street crossing may want to learn how to use a stopwatch or how to make a trundle wheel. Children comparing different brands of paper towels may want to learn how to design an experiment and how to make a bar graph. The list can go on and on, but the pattern is clear; solving a real problem requires skills.

Purpose of 'How To' Series

Written resources that help children learn skills like designing an opinion survey and choosing the appropriate measuring tool are not readily available for elementary school students. However, the USMES "How To" Series fills this gap. Its cartoon-style format helps younger children and those with reading difficulties acquire the skills and knowledge they need to do things like redesign their classroom, find the best buy in potato chips, or run a school store.



How to Use the 'How To' Series

Wait for a need. When a student asks for help, refer him or her to the appropriate booklet. Having a child read a booklet before there is a need to do so will not only result in less effective learning but will defeat the USMES purpose of allowing children to decide what needs to be done.

When necessary, use the "How To" Series as a teaching aid. Most of the time children will be able to go through a booklet by themselves and learn the skills they need to learn. However, some material in some sets is difficult and somewhat abstract. Such sections are usually towards the ends of booklets and often labeled "extra." When the booklet by itself is not doing the job, feel free to step in and help the student go through it.

Knowing how the content of the booklets are organized may help in using the series effectively.

- Each cover page summarizes what is in the booklet by illustrating the general problem and solution.
- Each booklet contains several examples of children using the skill being taught. Each example emphasizes a different aspect of the skill or a potential pitfall.
- Where a skill covered in one booklet is used in another, there is a reference in the form: See "How To...."

OTHER USMES 'HOW TO' SERIES

Intermediate "How To" Series: This magazine-style series covers in more detail essentially the same material as the cartoon-style series with a few booklets on additional skills. This series gives students a chance to read something they have a need to read.

Design Lab "How To" Series: These illustrated cards help children learn how to use tools safely and effectively.

"How To" Cards: These cards are printed on colored card stock rather than paper as the other series are. They contain fewer words than the *Intermediate "How To" Series* and utilize the American system of units (ft.-lb.-sec.) rather than the metric system.

BEGINNING "HOW TO" SERIES

BIOLOGY

How To
- Make a Home for Your Animal
- Make a Home for Your Rodent

COLLECTING DATA

How To
- Record Data
- Do an Experiment
- Make an Opinion Survey
- Choose a Sample

ELECTRICITY

How To
- Make Simple Circuits
- Make a Circuit Stay Together
- Add Things to a Circuit
- Make and Use Switches
- Fix a Circuit

GRAPHING

How To
- Choose Which Graph to Make
- Make a Bar Graph
- Make a Bar Graph Histogram
- Make a Conversion Graph
- Make a Line Chart
- Make a Line Graph
- Make a Scatter Graph
- Make a Slope Diagram

MEASURING

How To
- Use a Stopwatch
- Choose the Right Tool to Measure Distance
- Use a Trundle Wheel
- Make a Scale Drawing
- Find the Speed of Things

SIMPLIFYING DATA

How To
- Round Off Data
- Find the Median
- Find the Average

Conceived and Written by:
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Art Director: John W. Saalfield

Production Assistance
Paula Lakeberg

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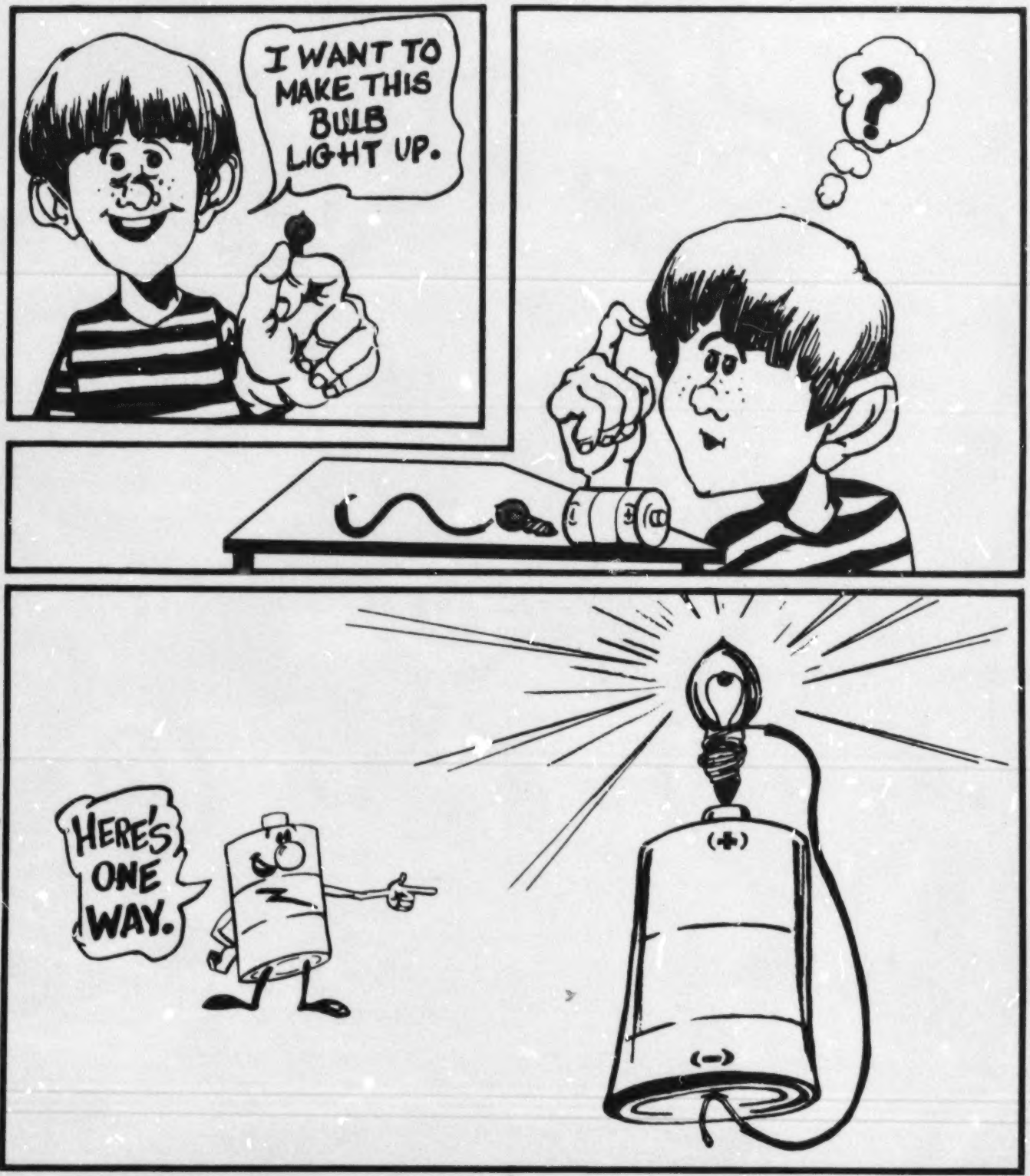
HOW TO

MAKE SIMPLE CIRCUITS



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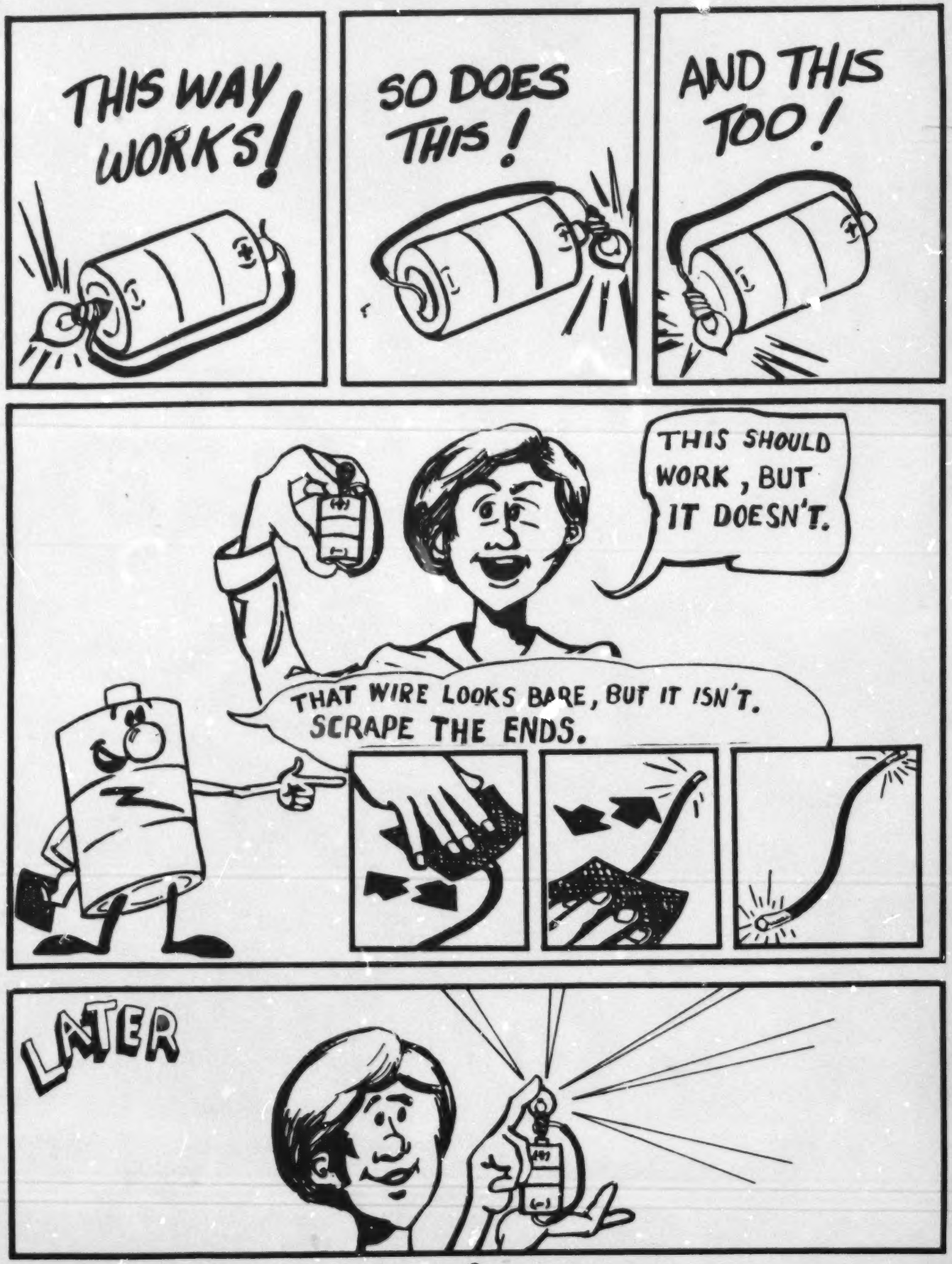
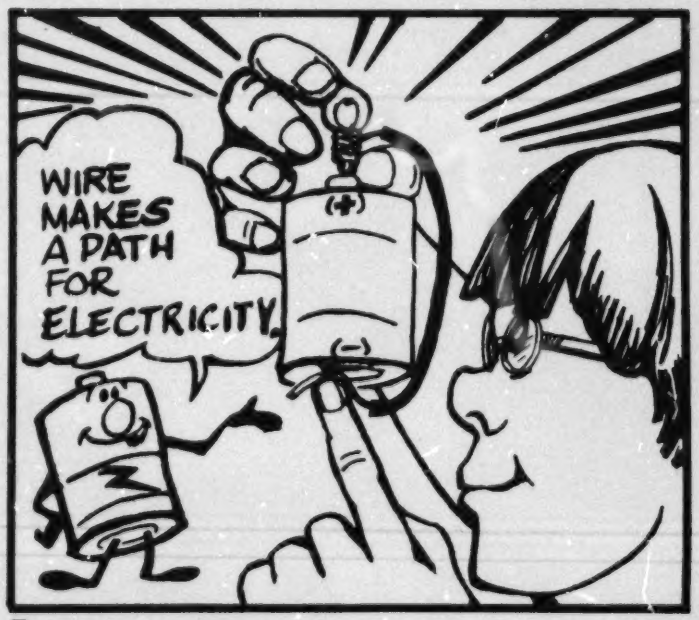
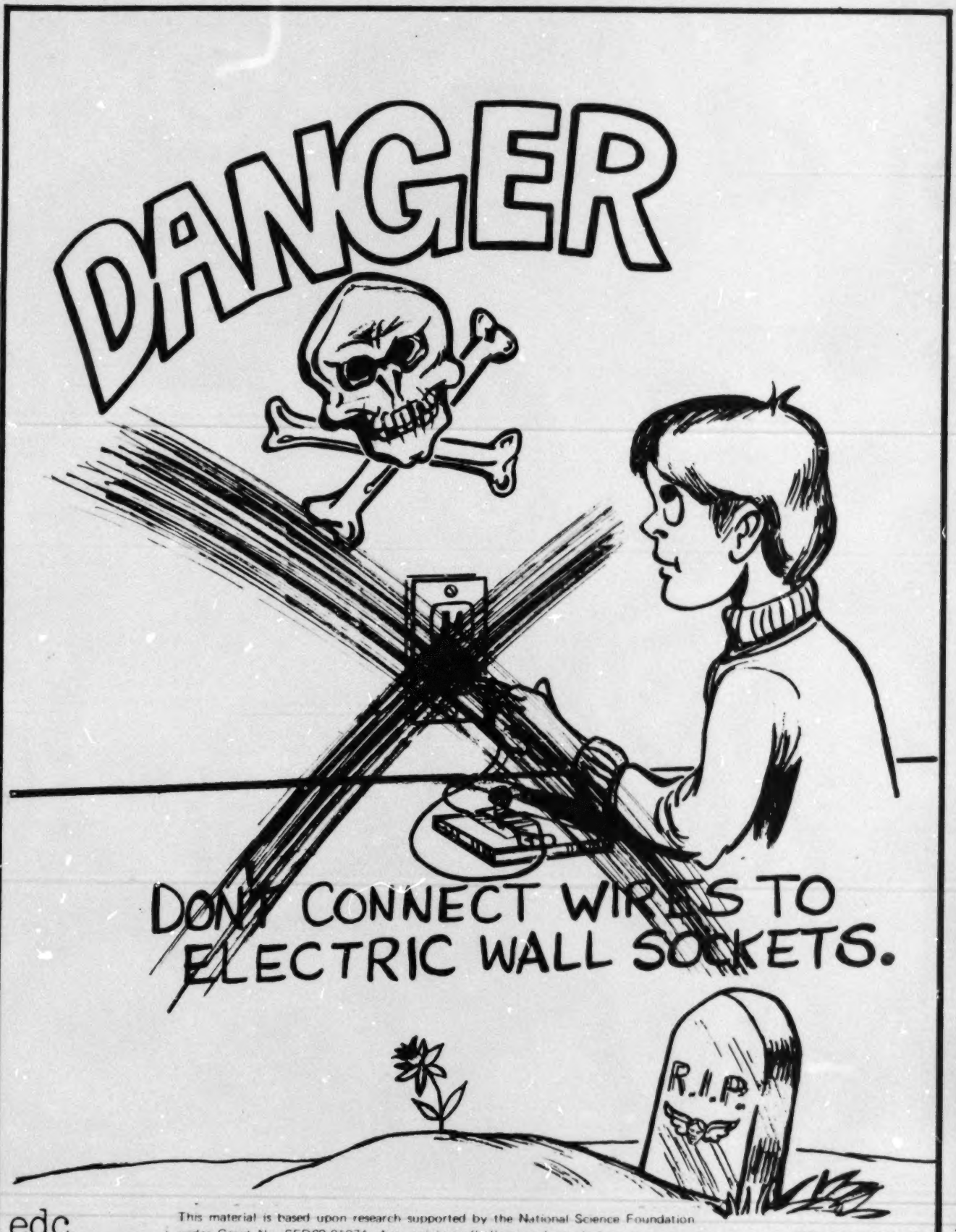

THIS WAY WORKS!
SO DOES THIS!
AND THIS TOO!
THIS SHOULD WORK, BUT IT DOESN'T.
THAT WIRE LOOKS BARE, BUT IT ISN'T. SCRAPE THE ENDS.
LATER

A BULB WILL LIGHT UP ONLY IF ELECTRICITY GOES THROUGH IT.

A BATTERY SUPPLIES THE ELECTRICITY.


WIRE MAKES A PATH FOR ELECTRICITY.



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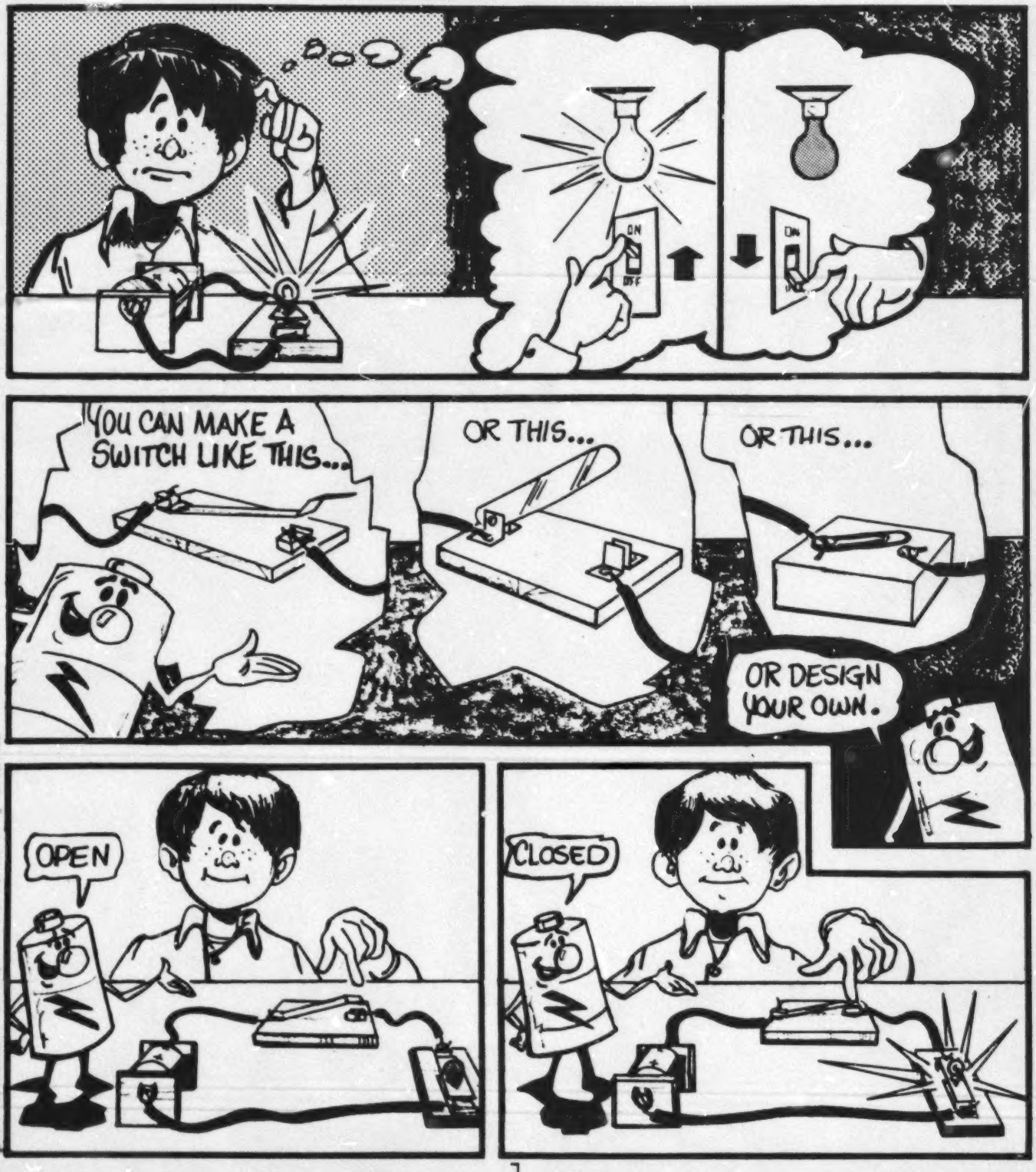
HOW TO
MAKE AND USE SWITCHES



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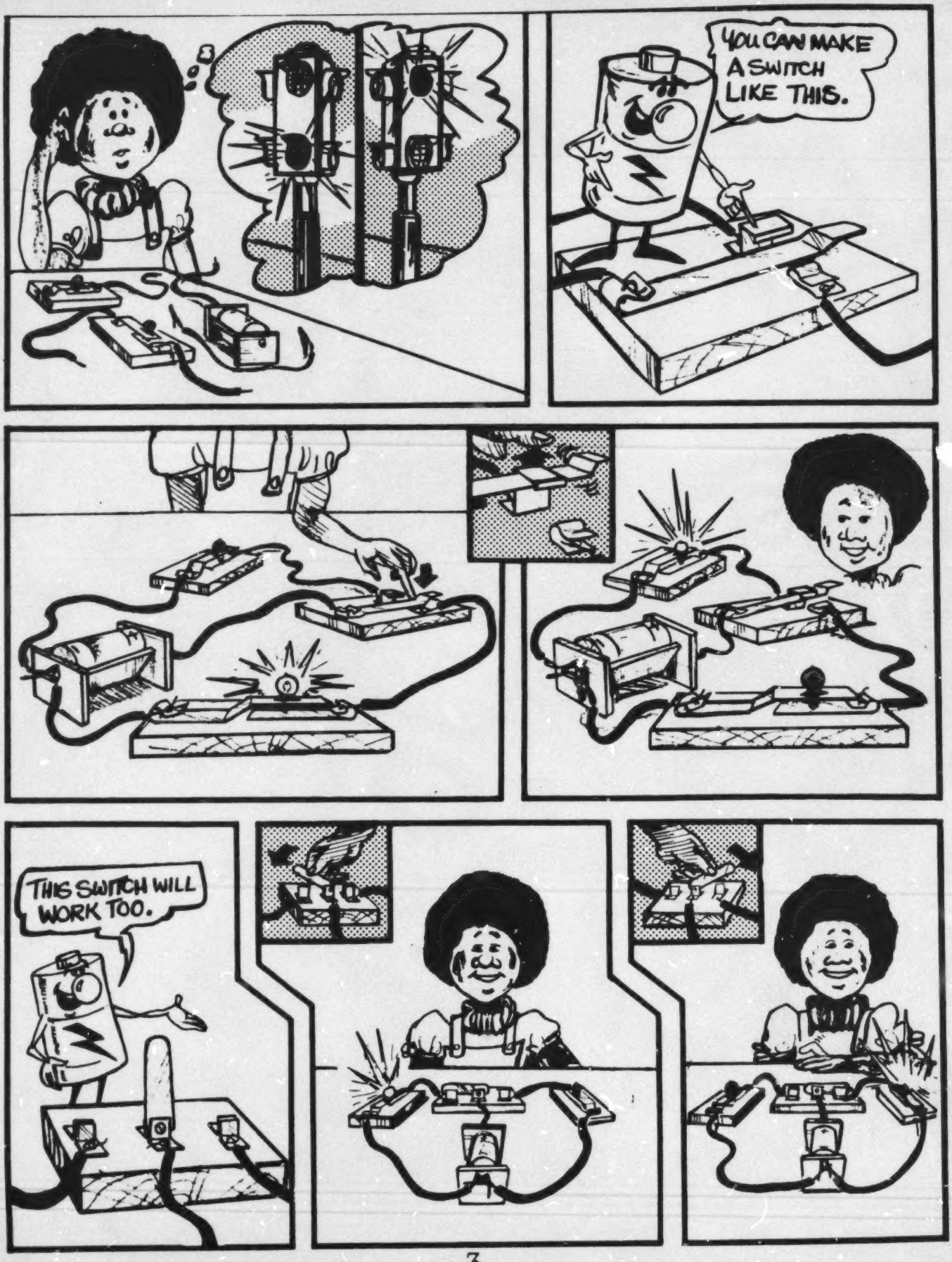
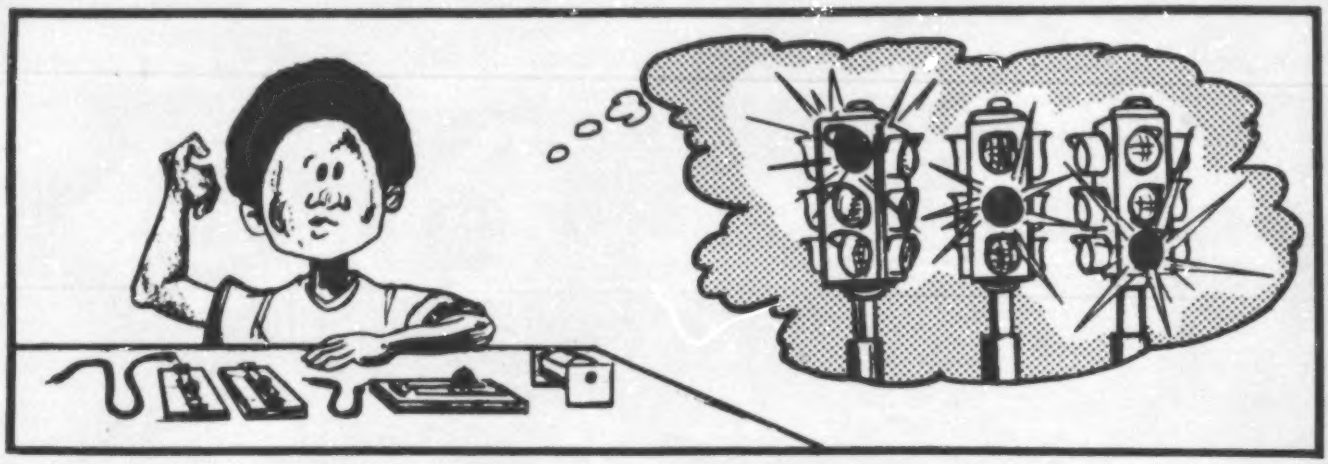
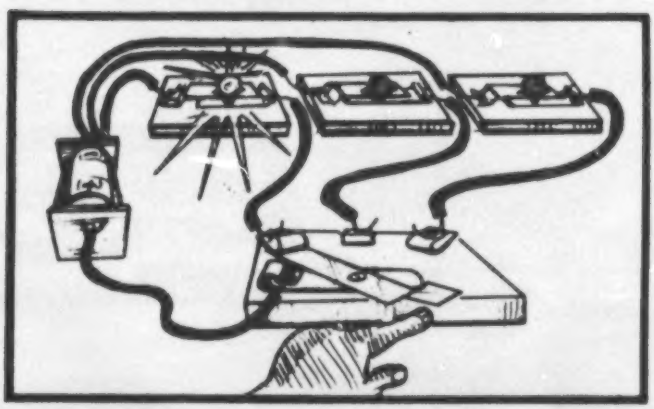
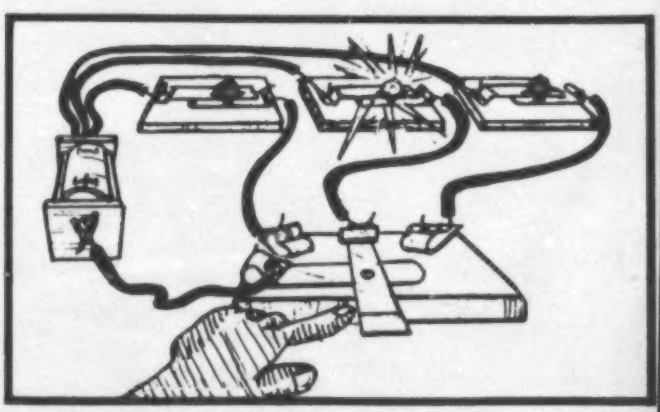
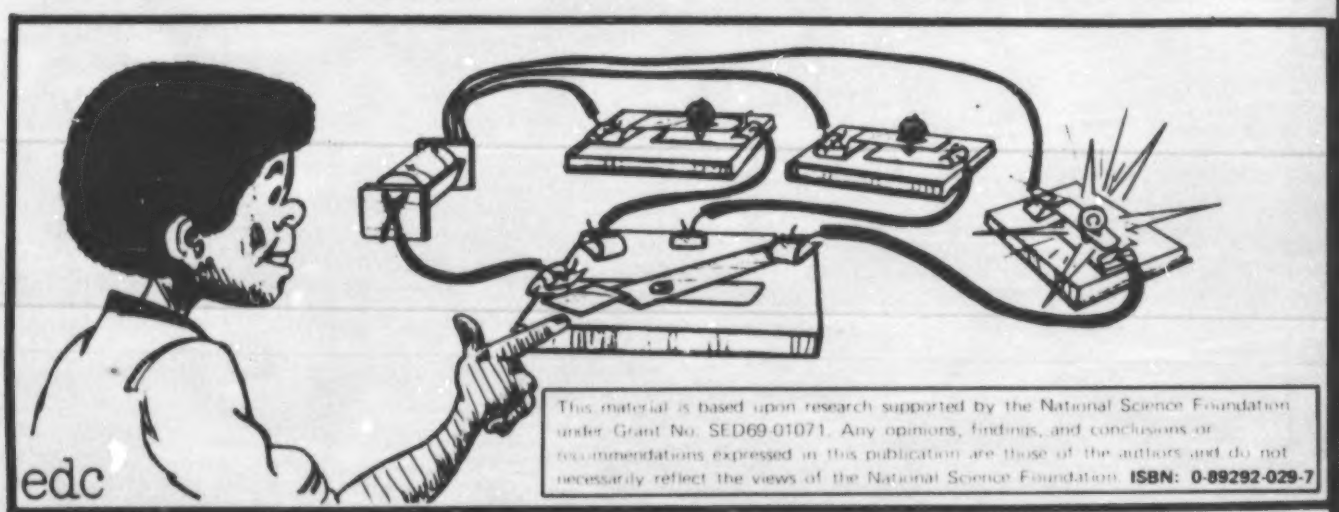
SLIDE THE STRIP...
UNDER THE CLIP.
THIS SWITCH STAYS CLOSED TOO.


YOU CAN MAKE A SWITCH LIKE THIS.
THIS SWITCH WILL WORK TOO.









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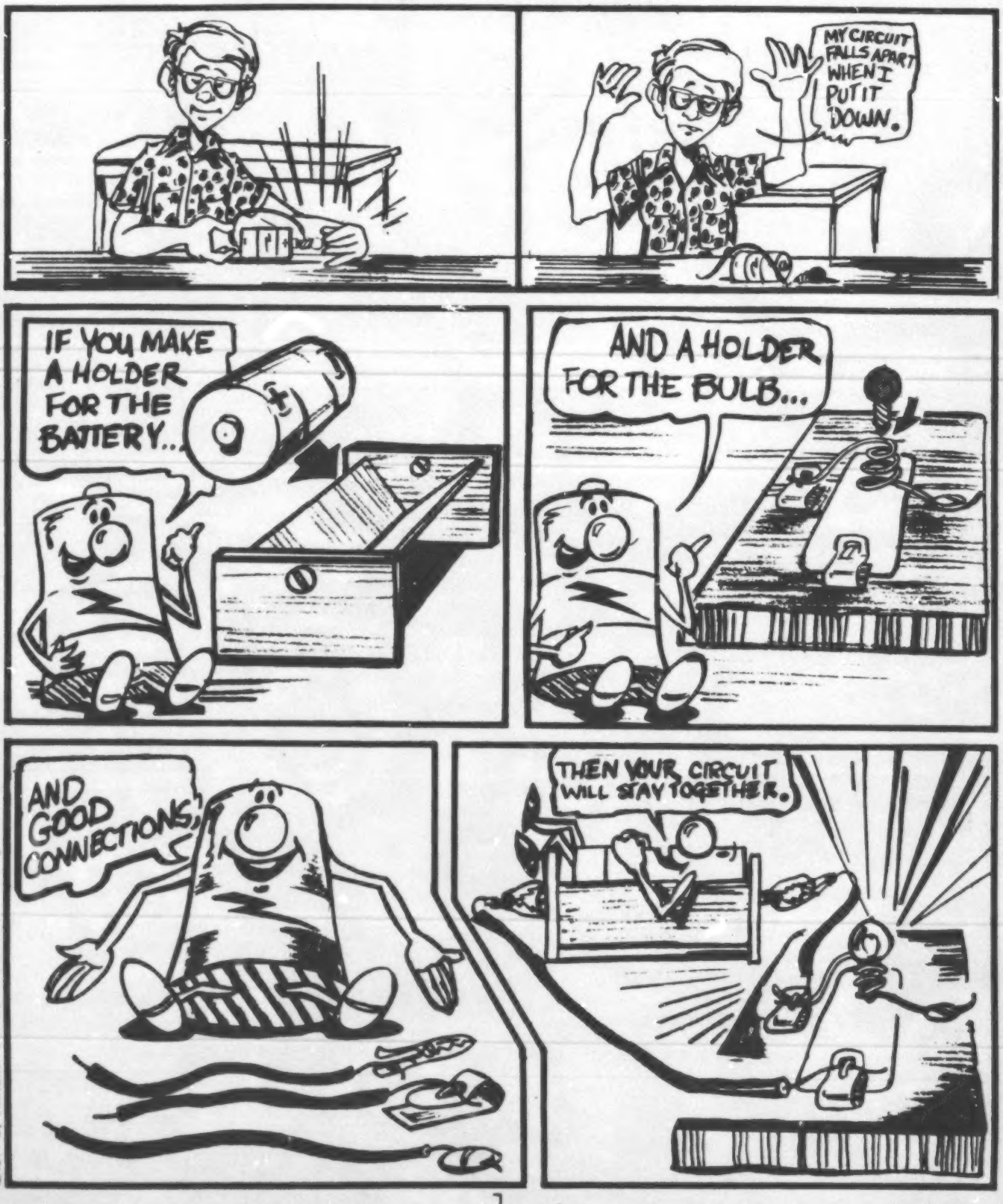
MAKE A CIRCUIT STAY TOGETHER

USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS


MY CIRCUIT FALLS APART WHEN I PUT IT DOWN.
IF YOU MAKE A HOLDER FOR THE BATTERY..
AND A HOLDER FOR THE BULB...
AND GOOD CONNECTIONS,
THEN YOUR CIRCUIT WILL STAY TOGETHER.

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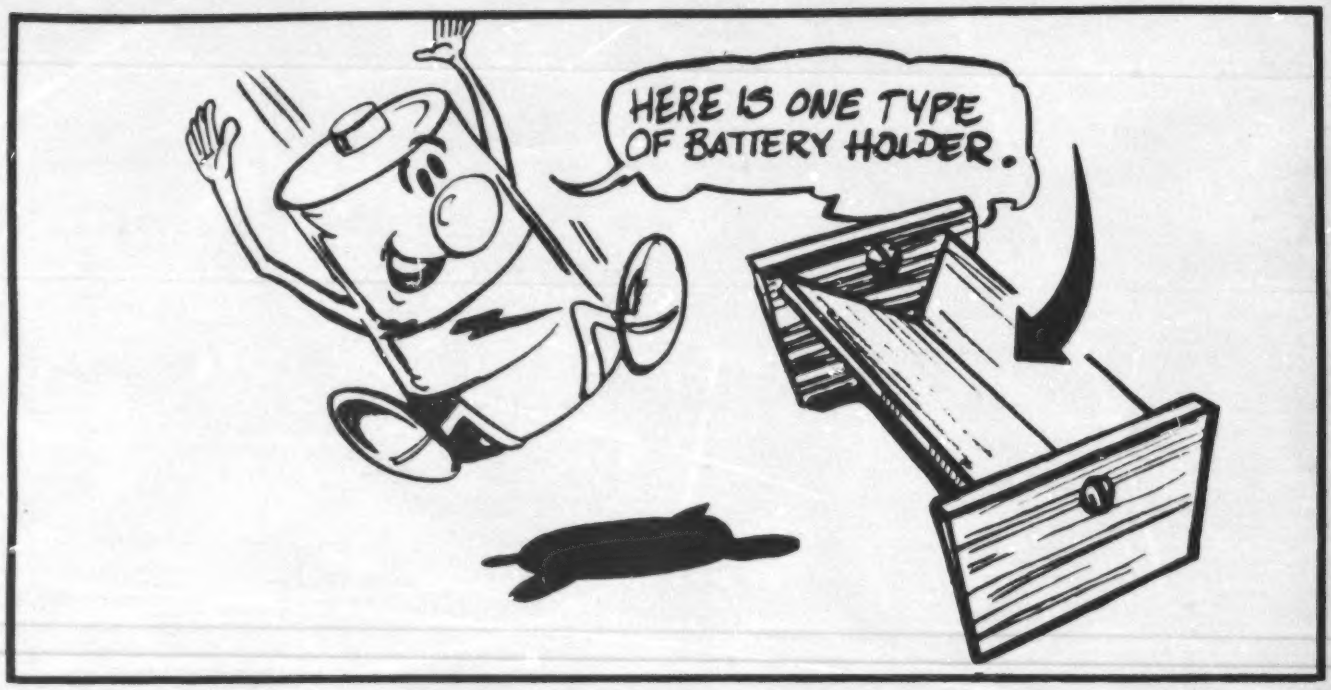
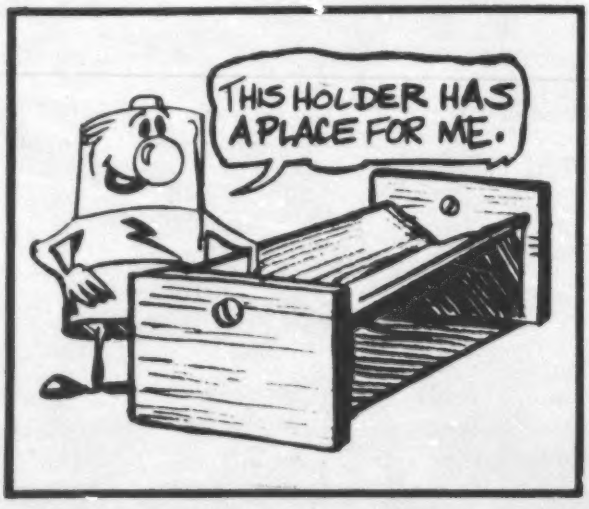
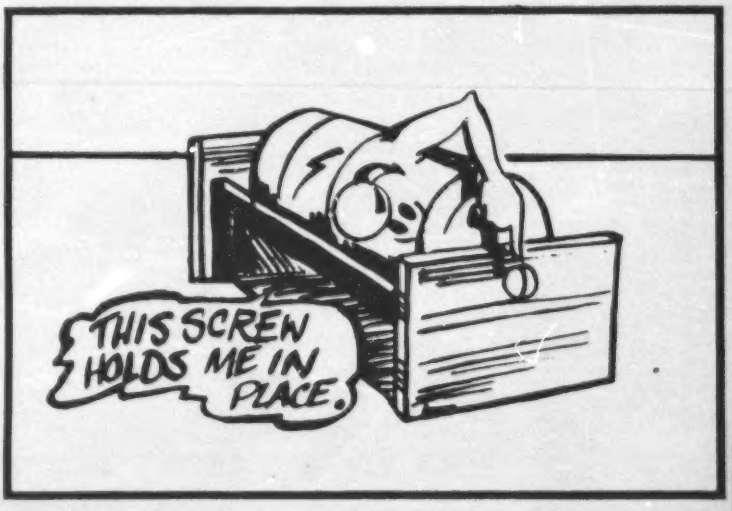
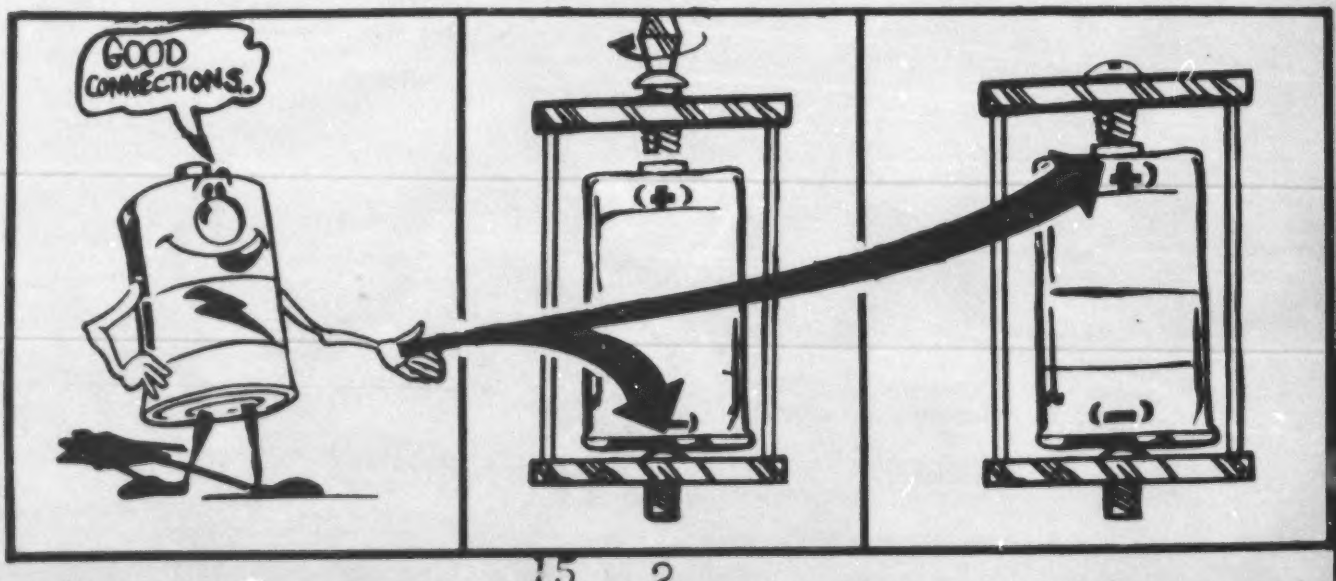

HERE IS ONE TYPE OF BATTERY HOLDER.


THIS HOLDER HAS A PLACE FOR ME.


THIS SCREW HOLDS ME IN PLACE.

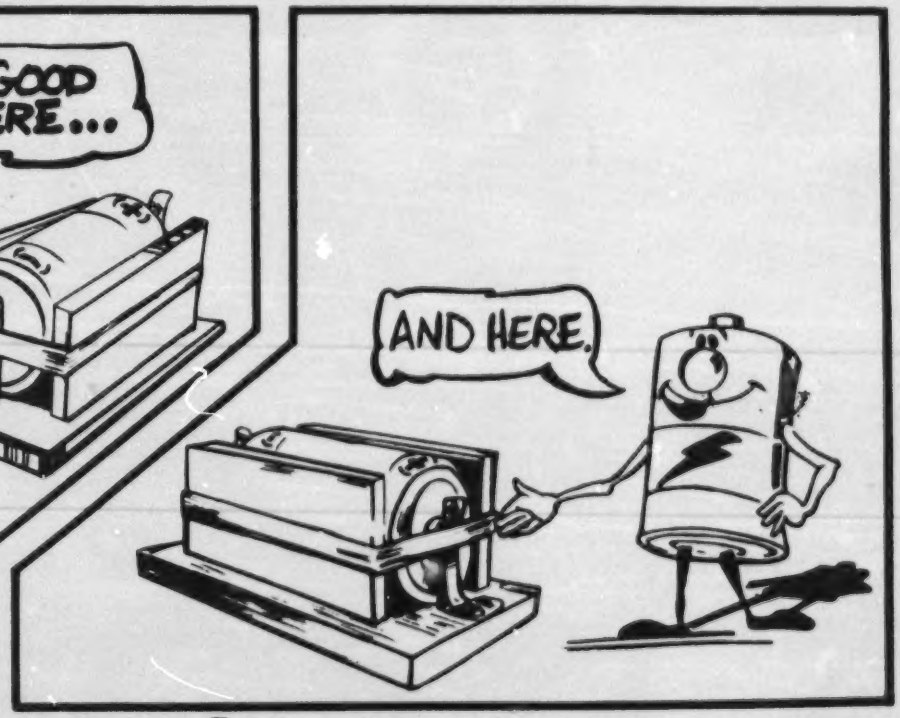

GOOD CONNECTIONS.

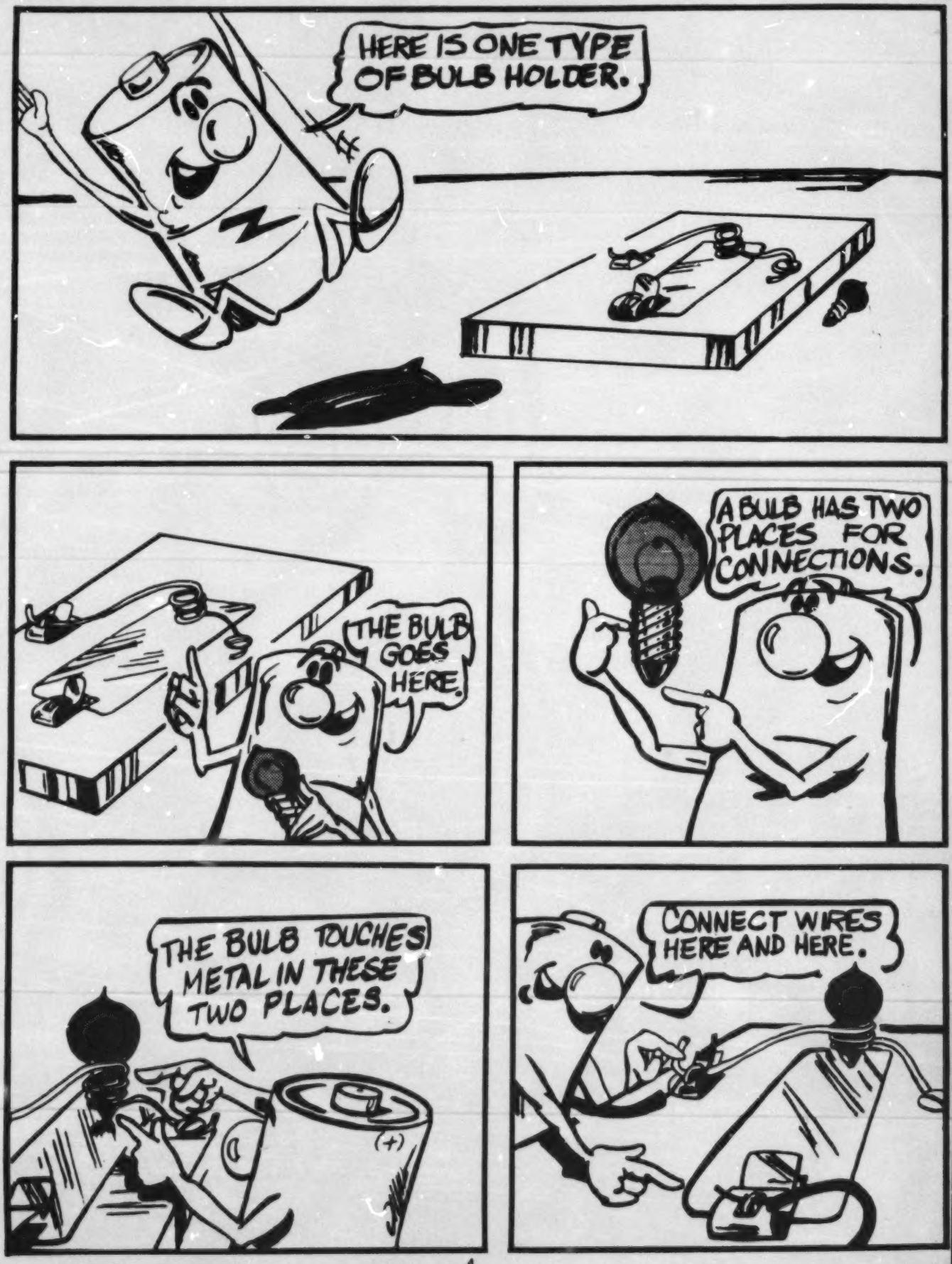
HERE IS ANOTHER BATTERY HOLDER.

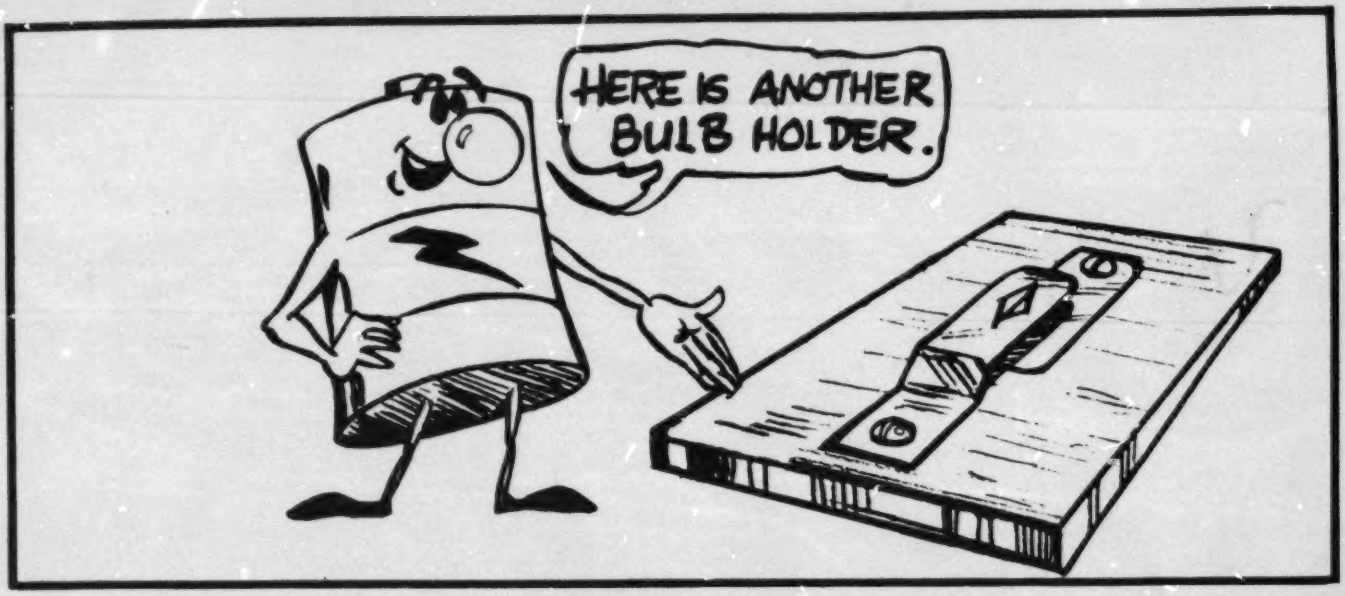
IT HAS A PLACE FOR ME...

AND A RUBBER BAND.

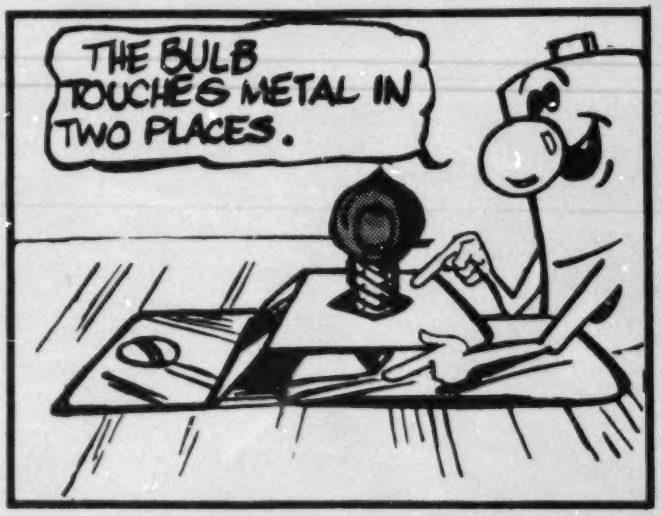
IT MAKES A GOOD CONNECTION HERE...

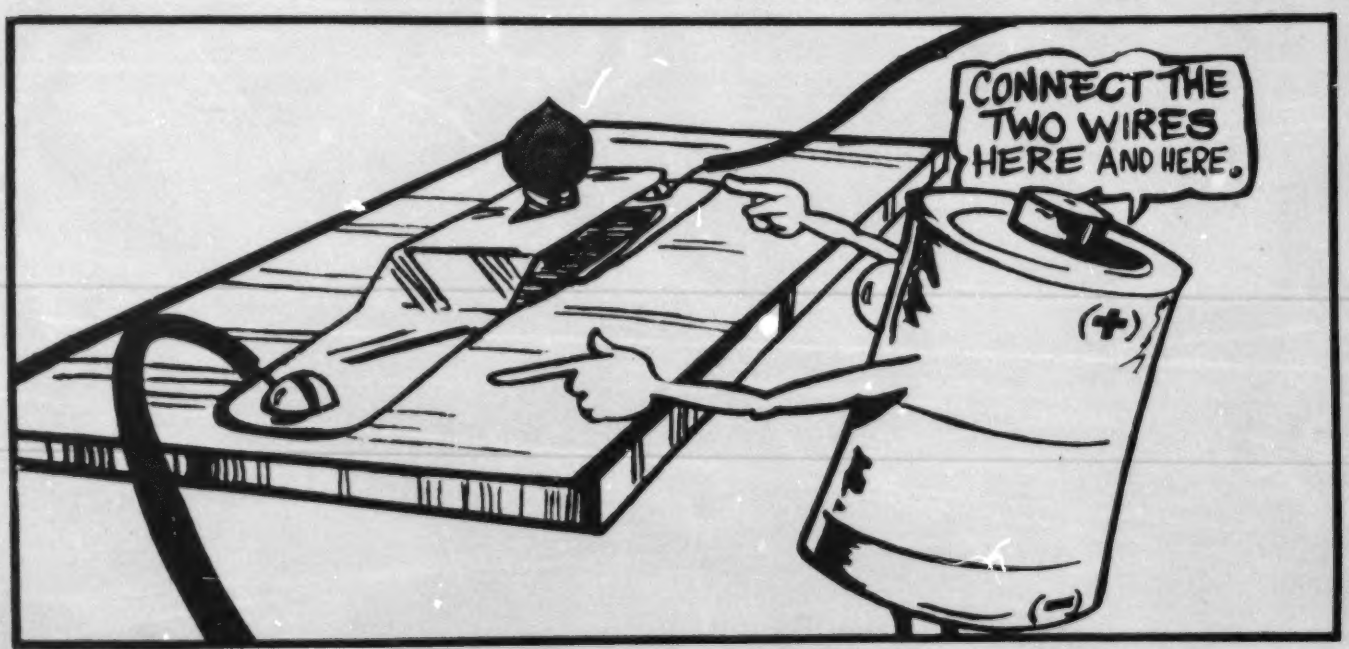

AND HERE.

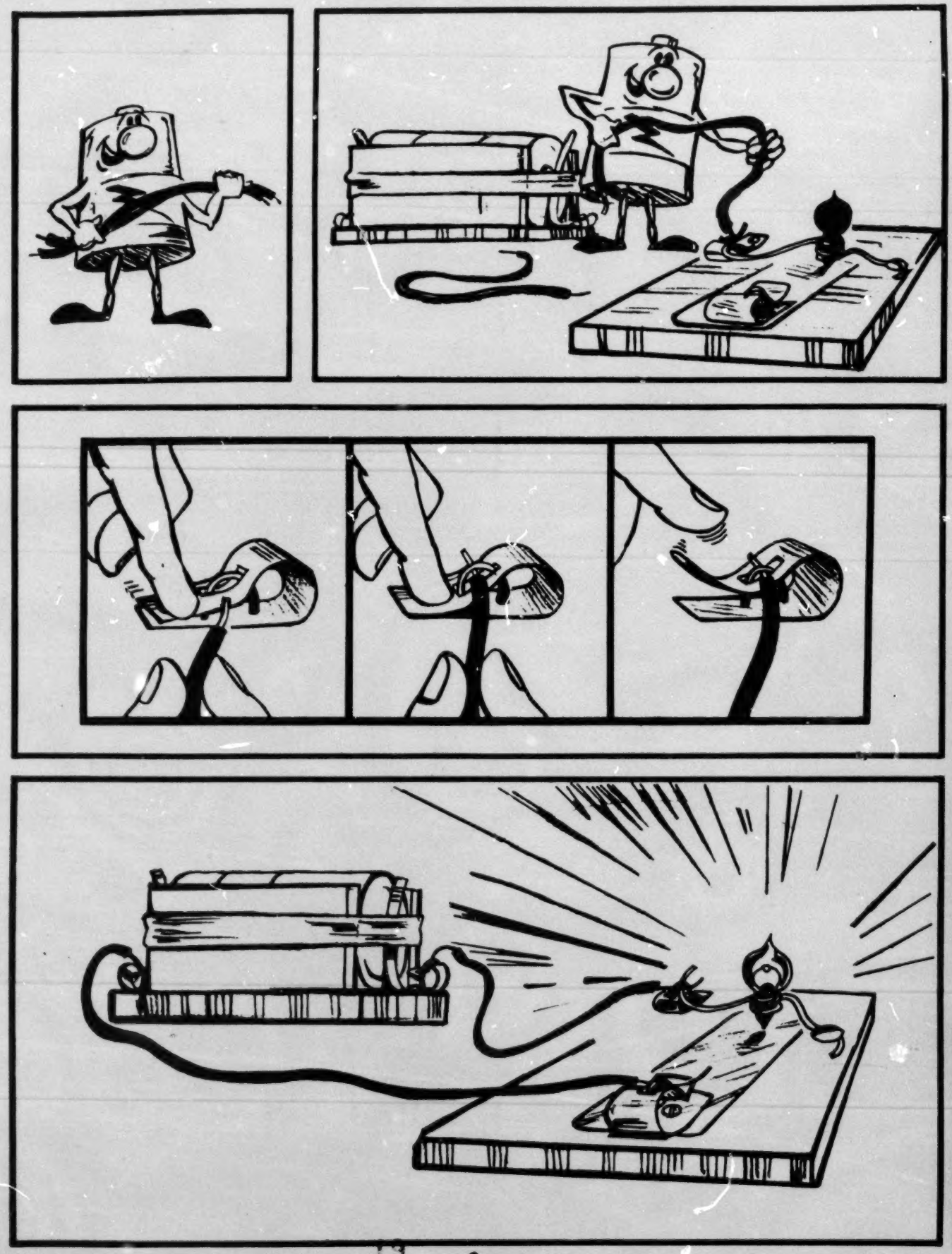

HERE IS ONE TYPE OF BULB HOLDER.
THE BULB GOES HERE.
A BULB HAS TWO PLACES FOR CONNECTIONS.
THE BULB TOUCHES METAL IN THESE TWO PLACES.
(+)
CONNECT WIRES HERE AND HERE.

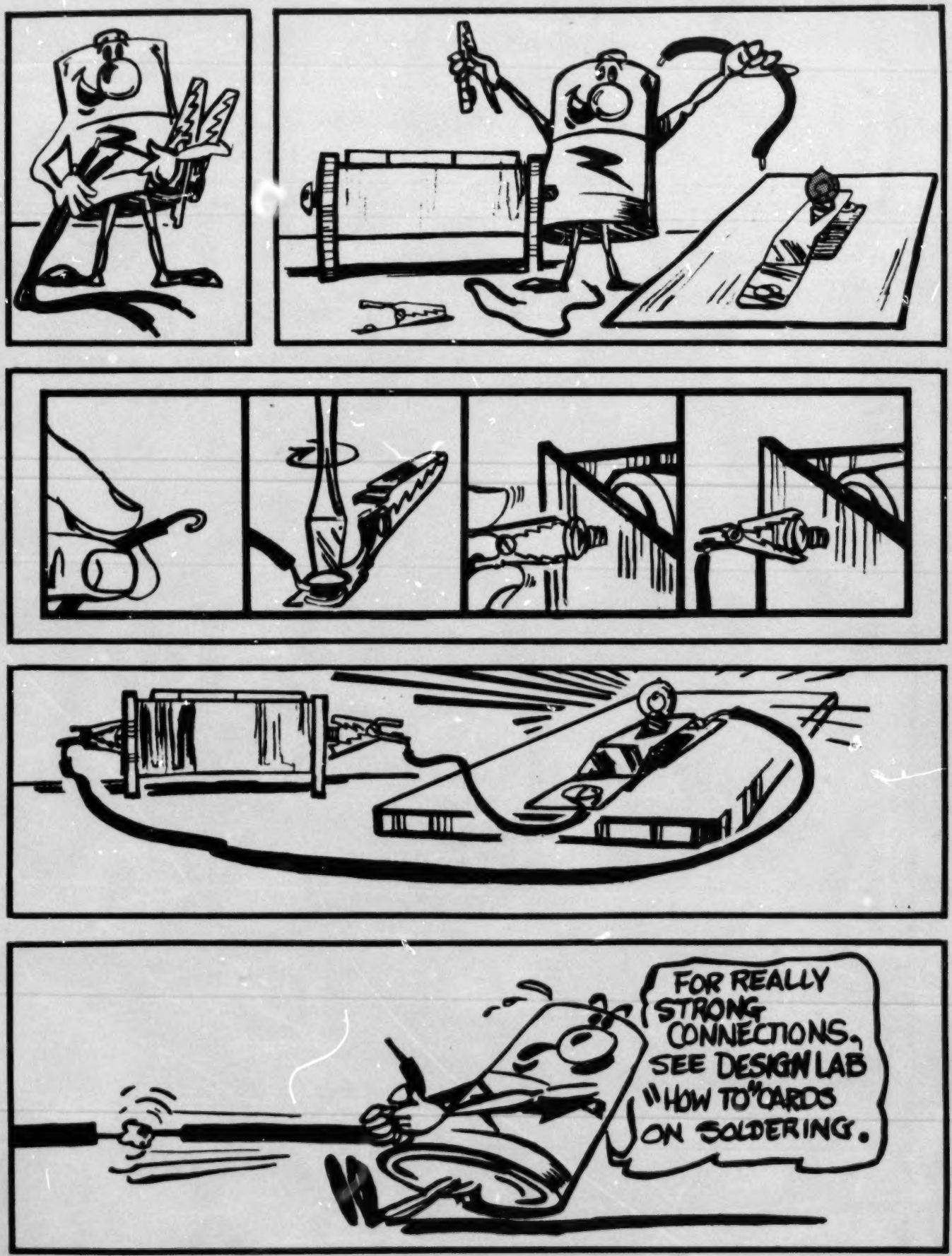

HERE IS ANOTHER BULB HOLDER.

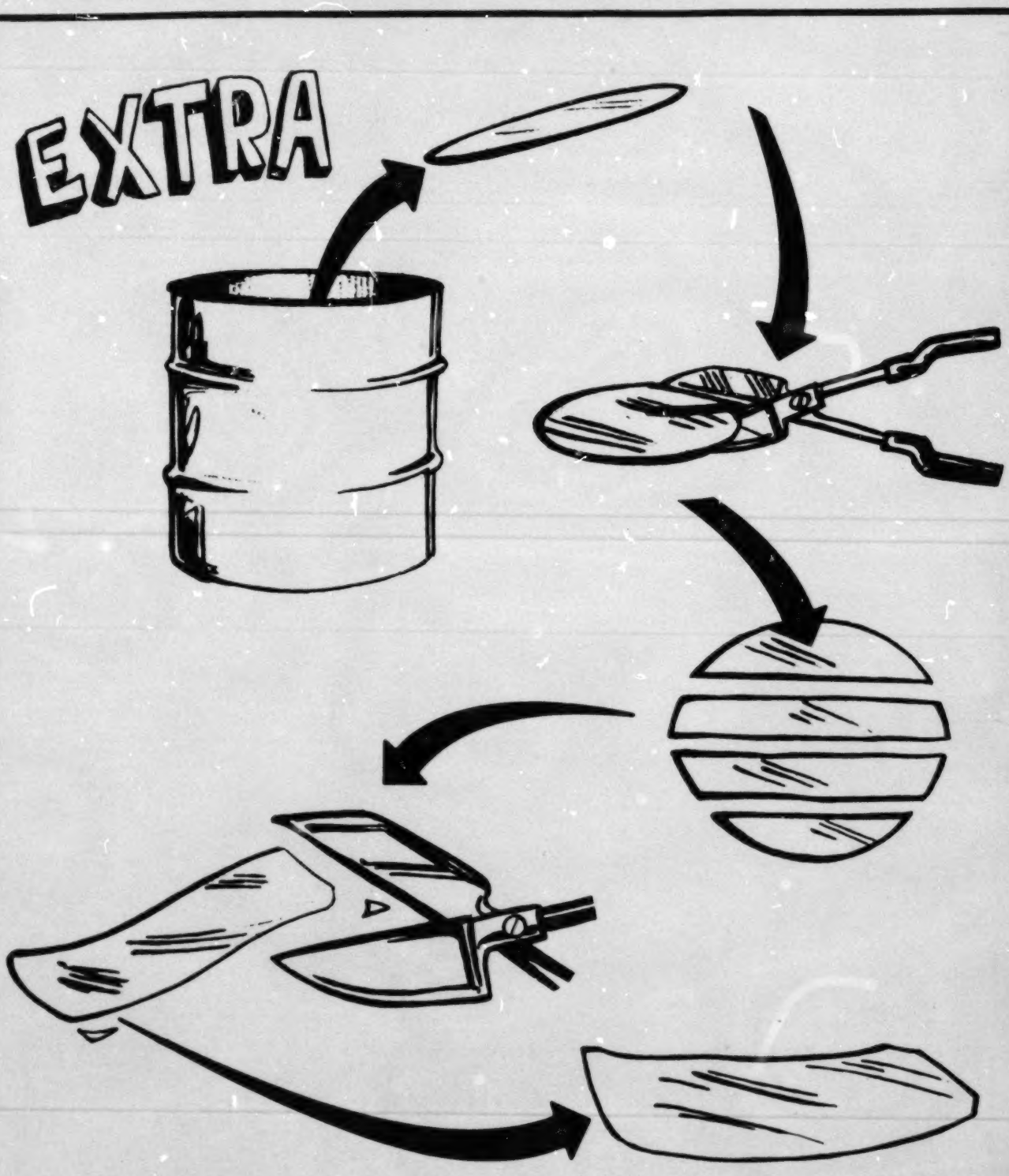
THE BULB SCREWS IN HERE.


THE BULB TOUCHES METAL IN TWO PLACES.


CONNECT THE TWO WIRES HERE AND HERE.
(+)
(-)




FOR REALLY STRONG CONNECTIONS, SEE DESIGN LAB "HOW TO" CARDS ON SOLDERING.



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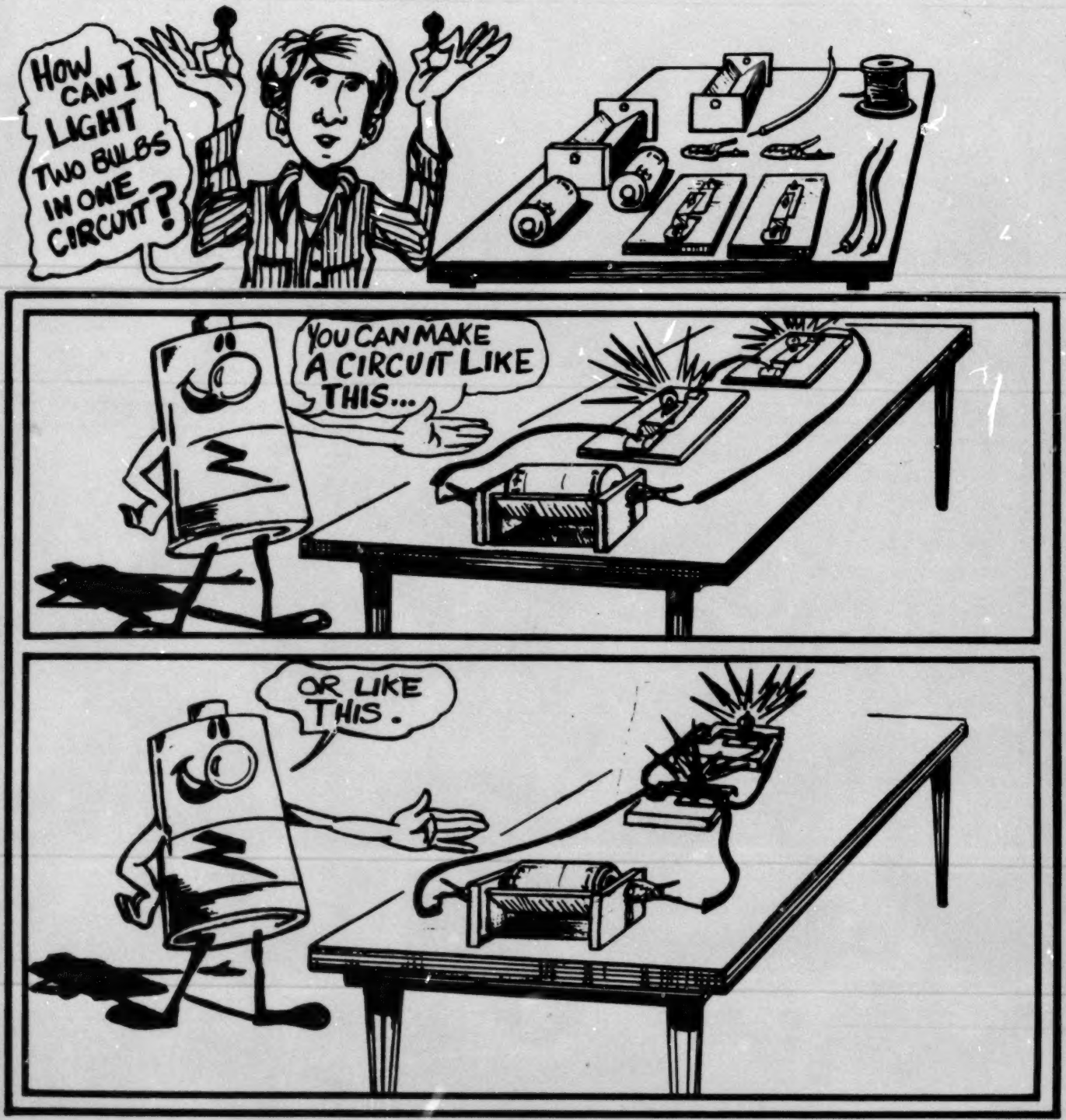
HOW TO

ADD THINGS TO A CIRCUIT



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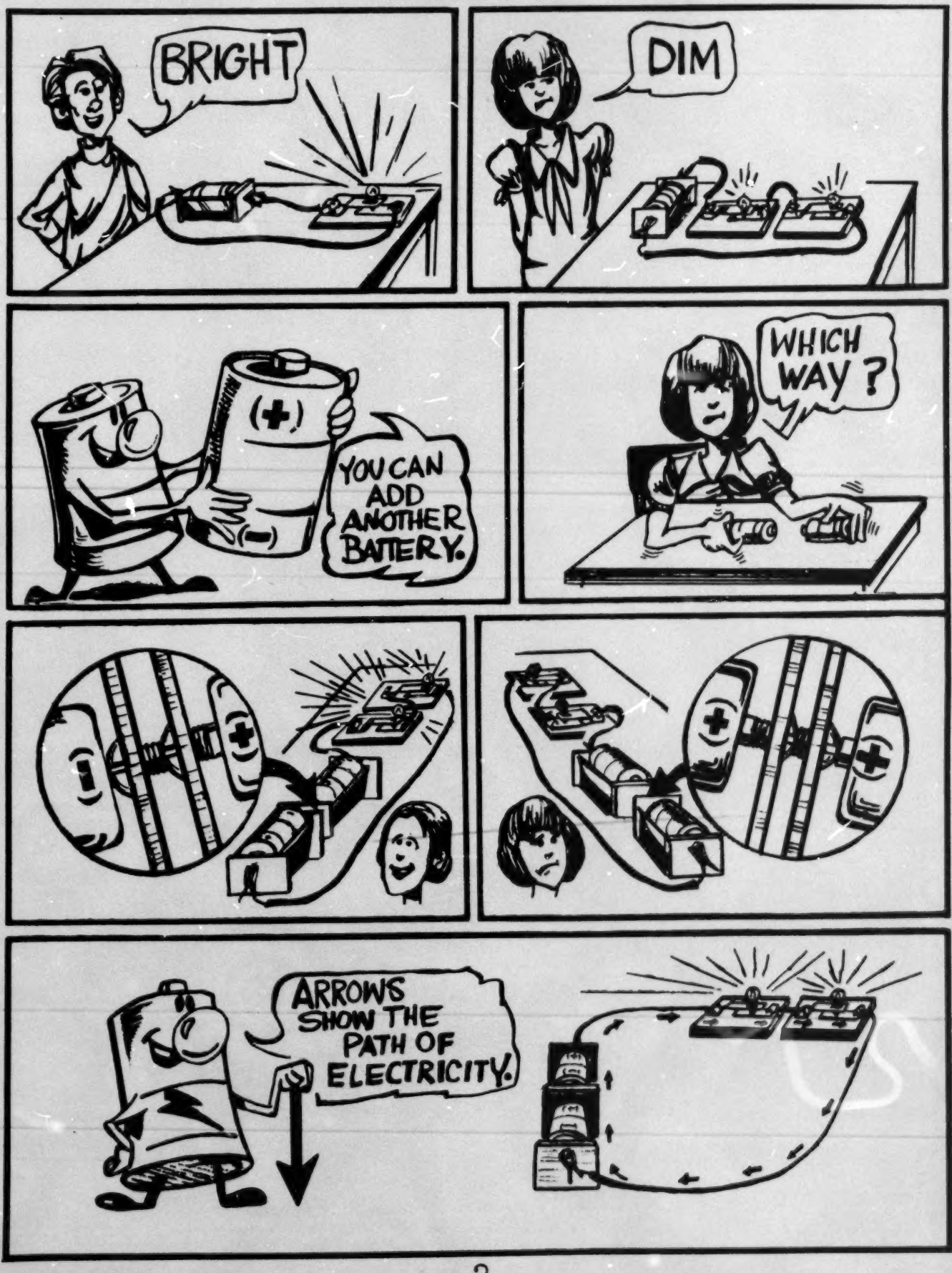
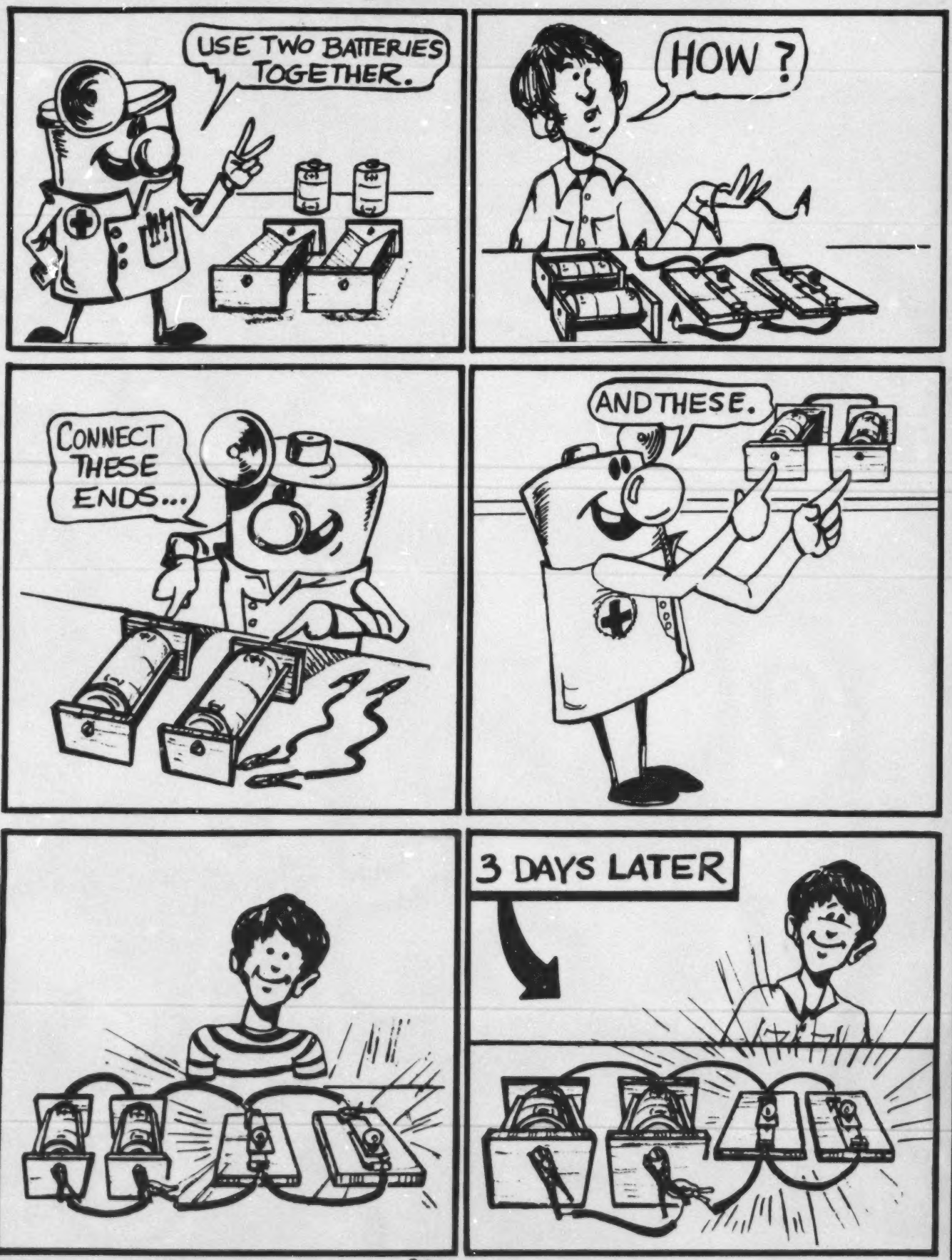
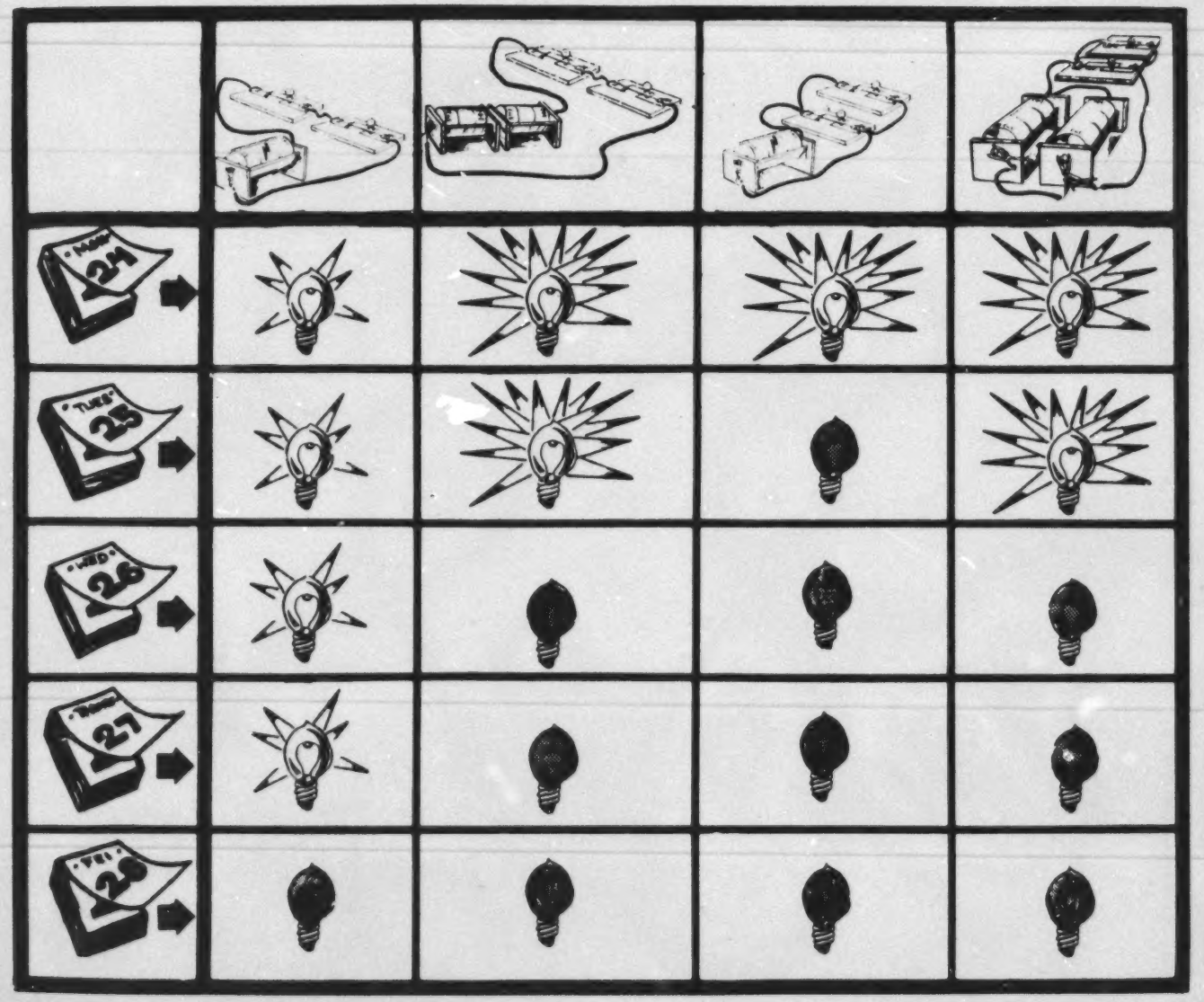
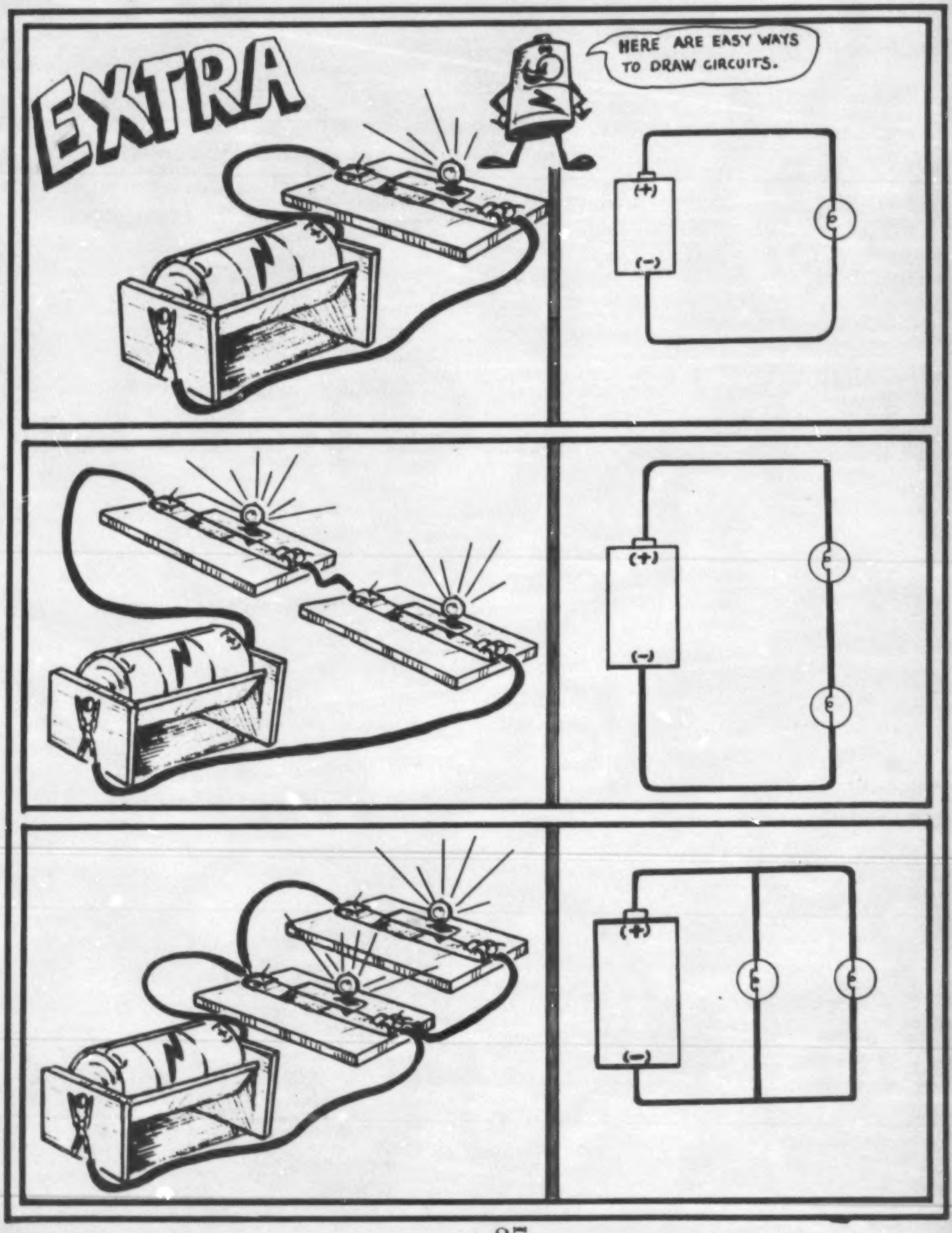

BRIGHT
DIM
(+)
(−)
YOU CAN ADD ANOTHER BATTERY.
WHICH WAY?
ARROWS SHOW THE PATH OF ELECTRICITY.

THESE BULBS ARE DIM...
...AND WHEN I TAKE OUT ONE BULB, THE OTHER GOES OUT.
THIS IS A SERIES CIRCUIT.
TRY A PARALLEL CIRCUIT.
A FEW DAYS LATER
IT WAS SO YOUNG.

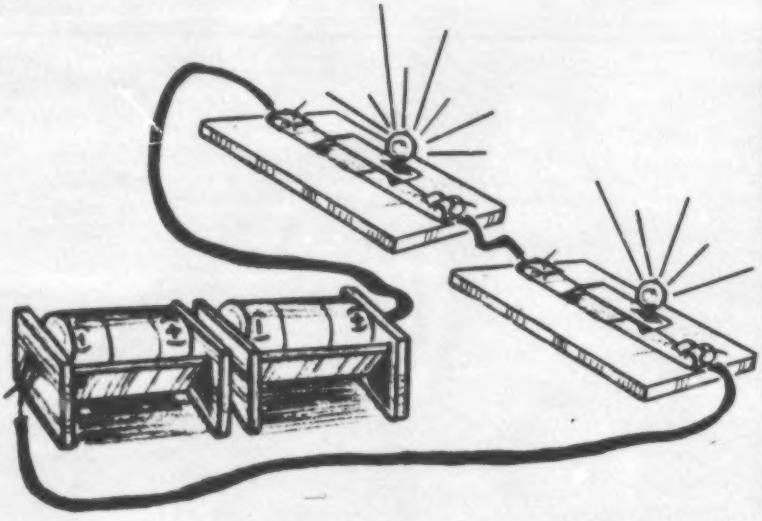

USE TWO BATTERIES TOGETHER.
HOW ?
CONNECT THESE ENDS...
AND THESE.
3 DAYS LATER

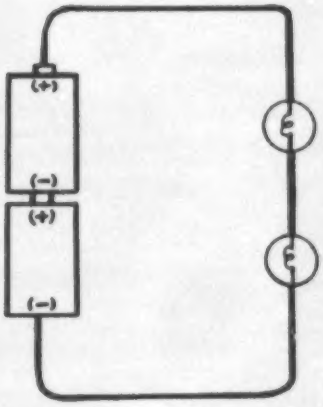
THE GREAT RACE

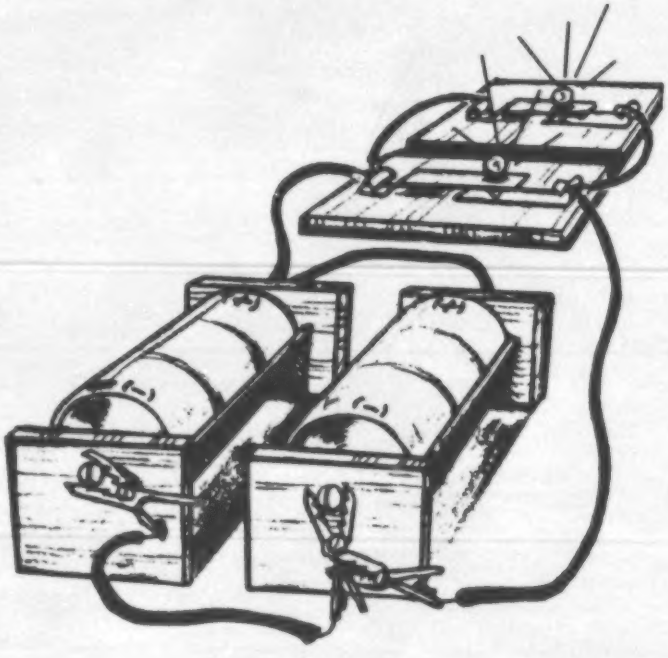

MON 24
TUES 25
WED 26
THU 27
FRI 28

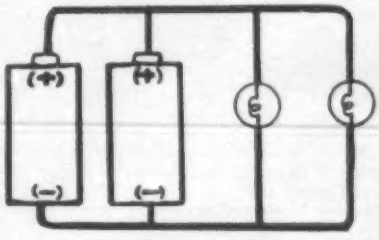

EXTRA
HERE ARE EASY WAYS TO DRAW CIRCUITS.
(+)
(-)
(+)
(-)
(+)
(-)

EXTRA



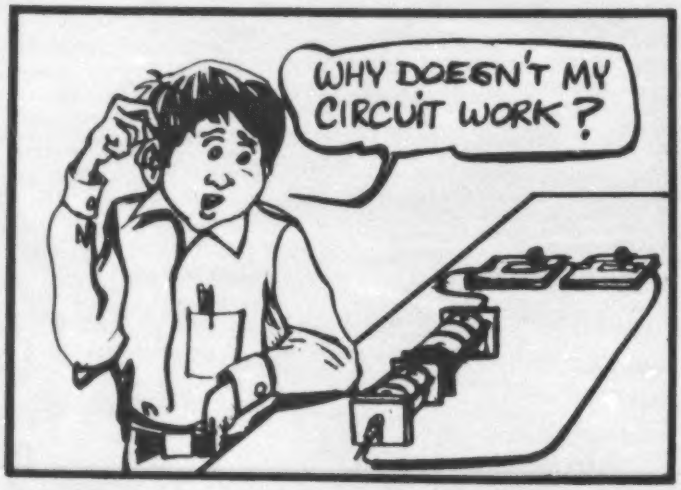


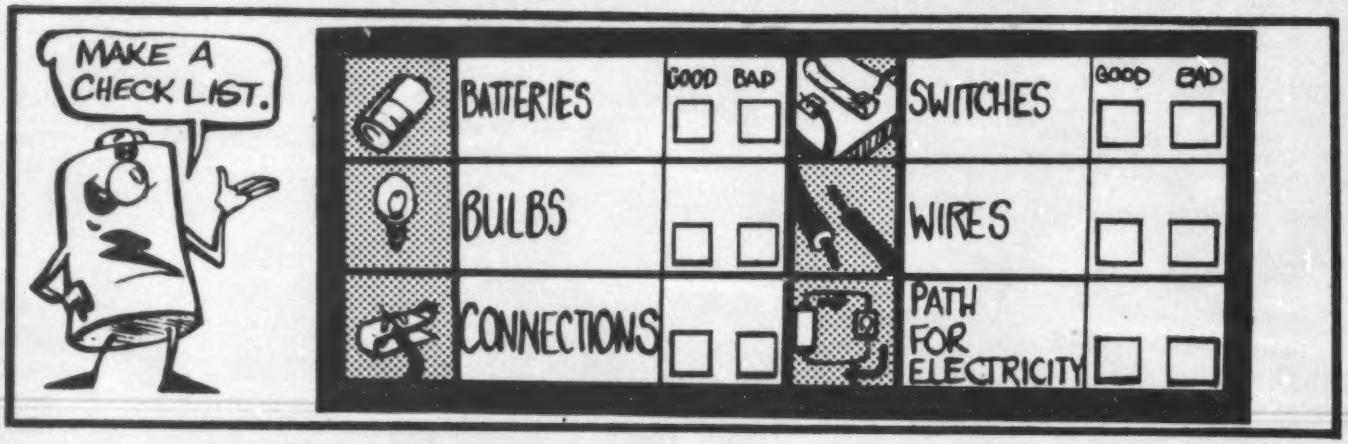




HOW TO

FIX A CIRCUIT





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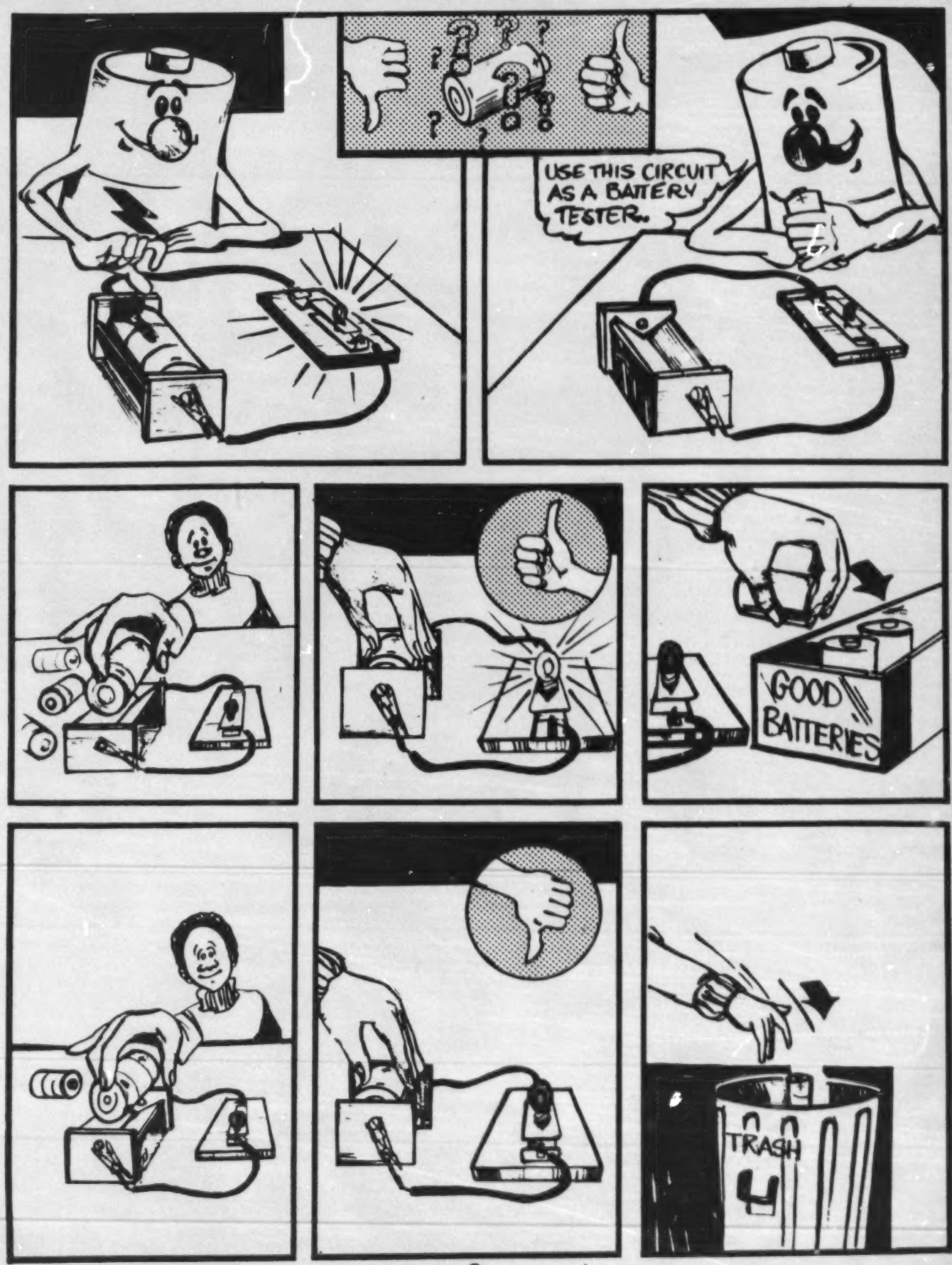
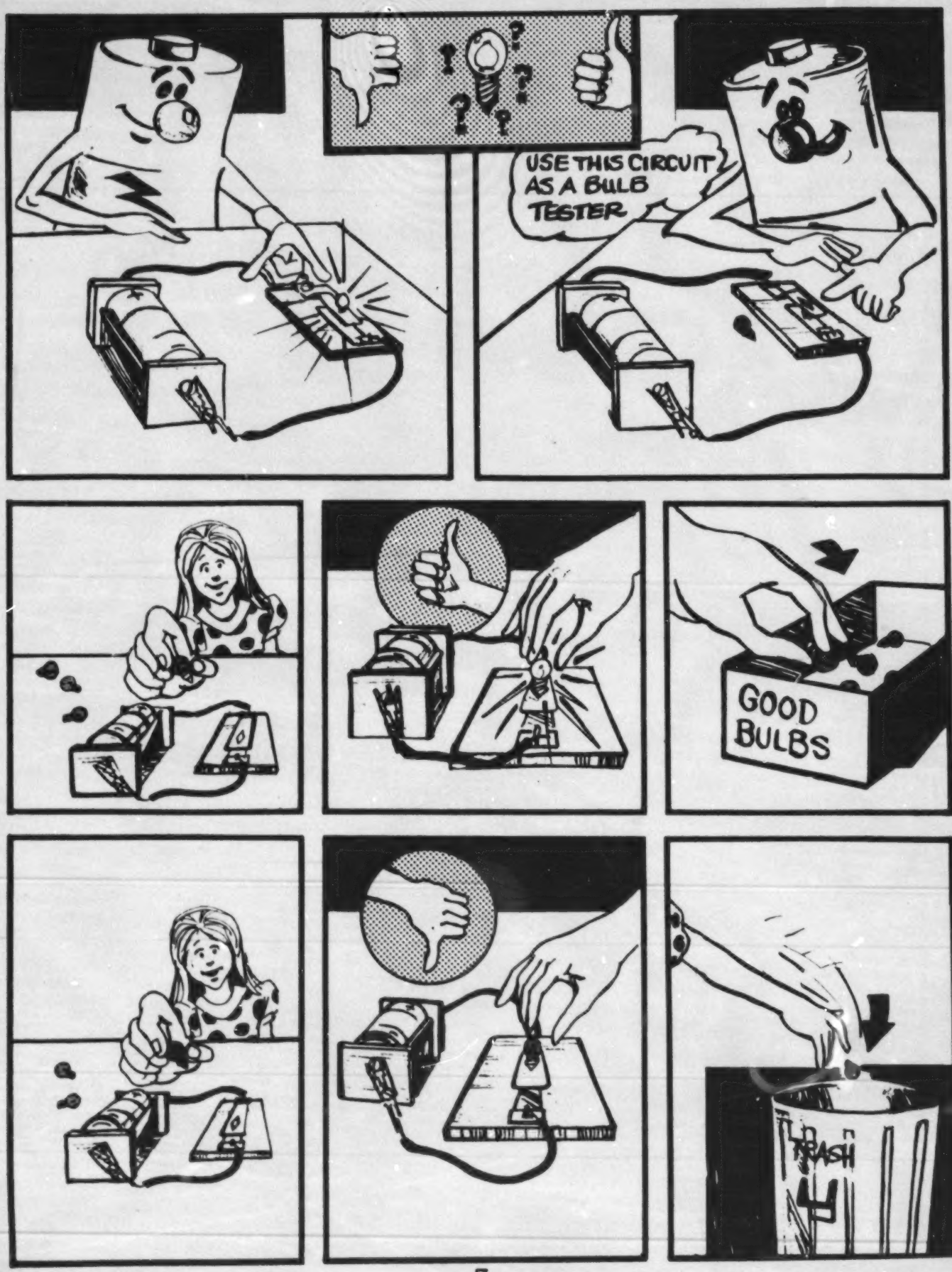
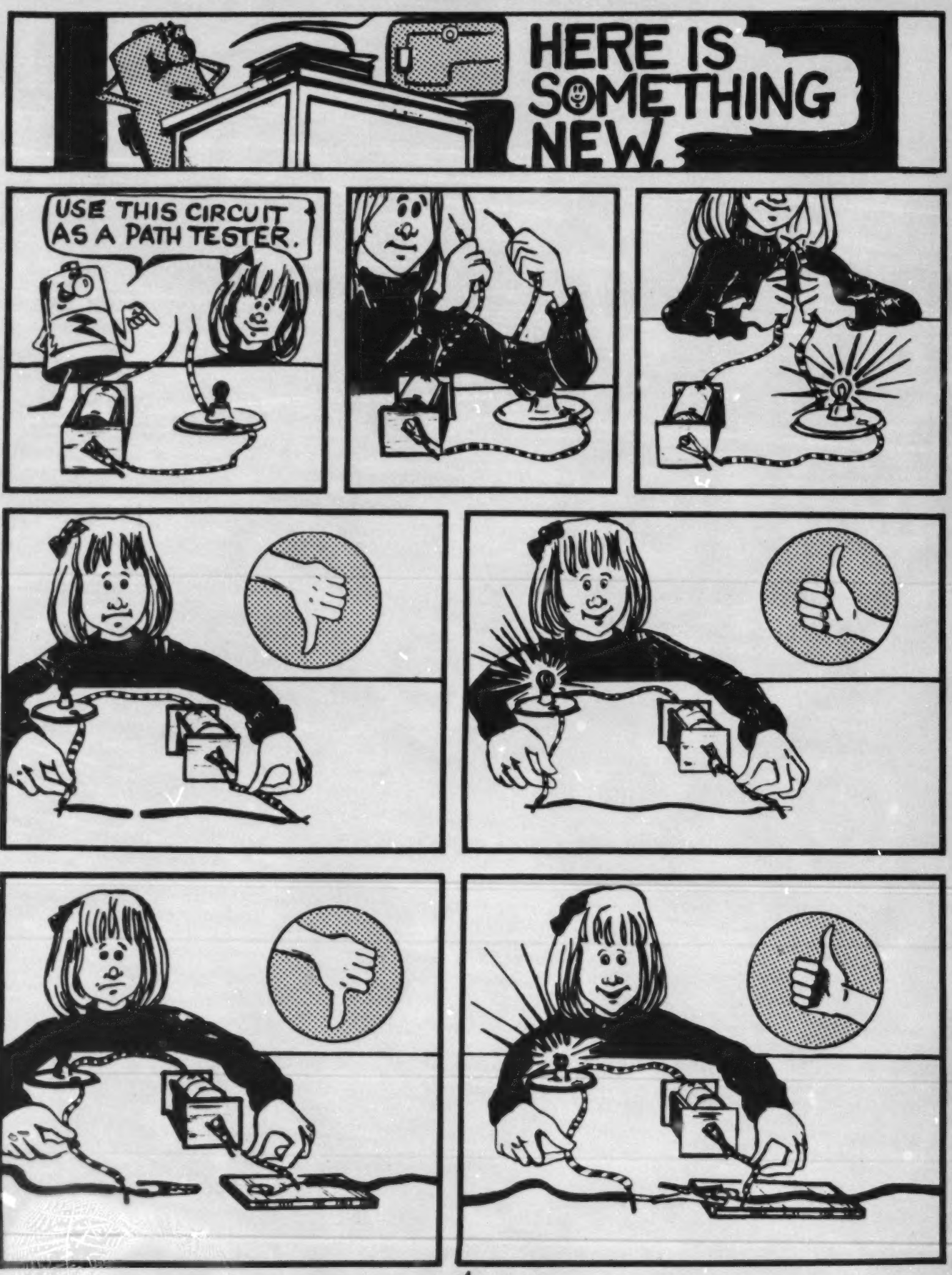
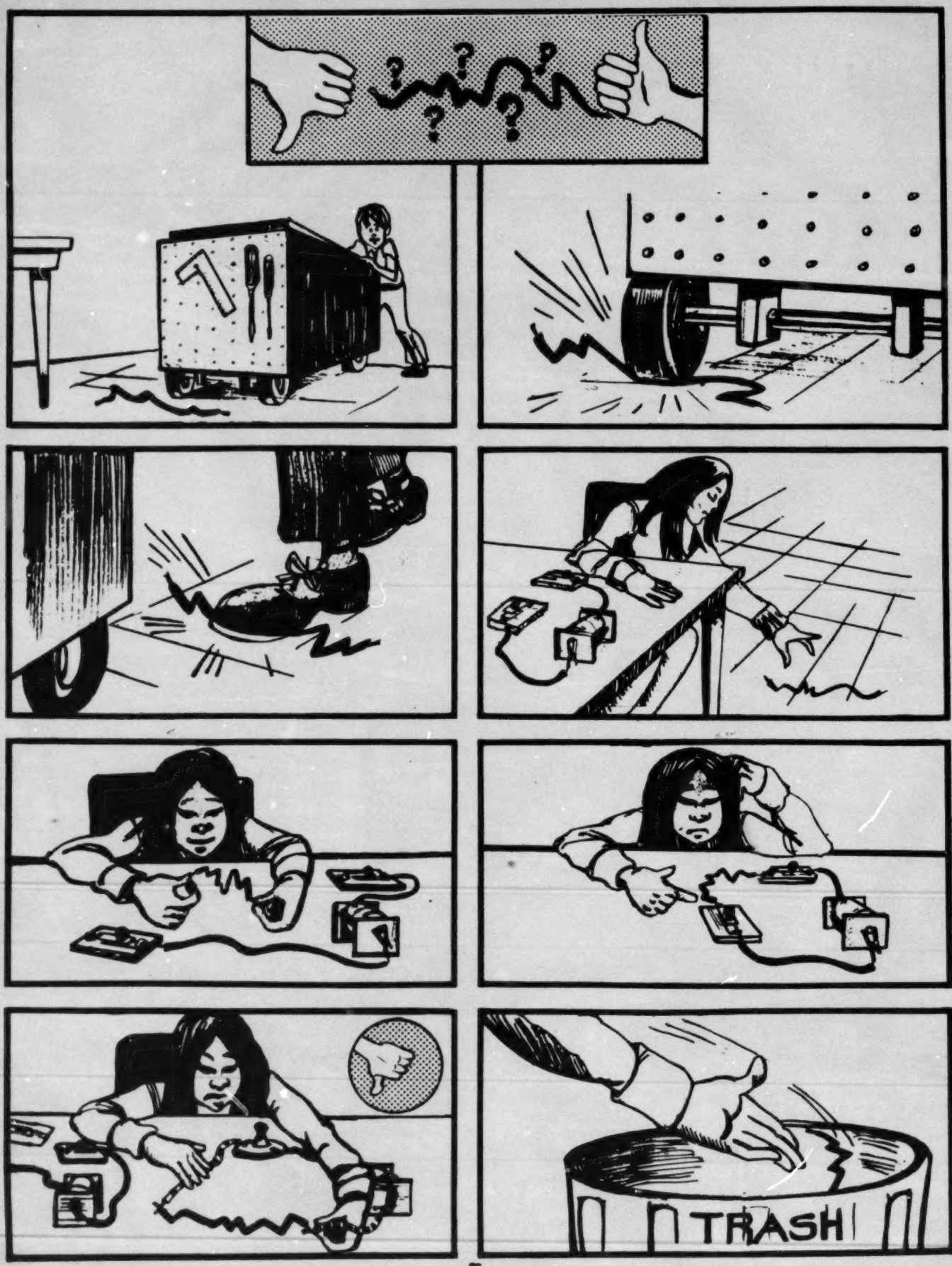
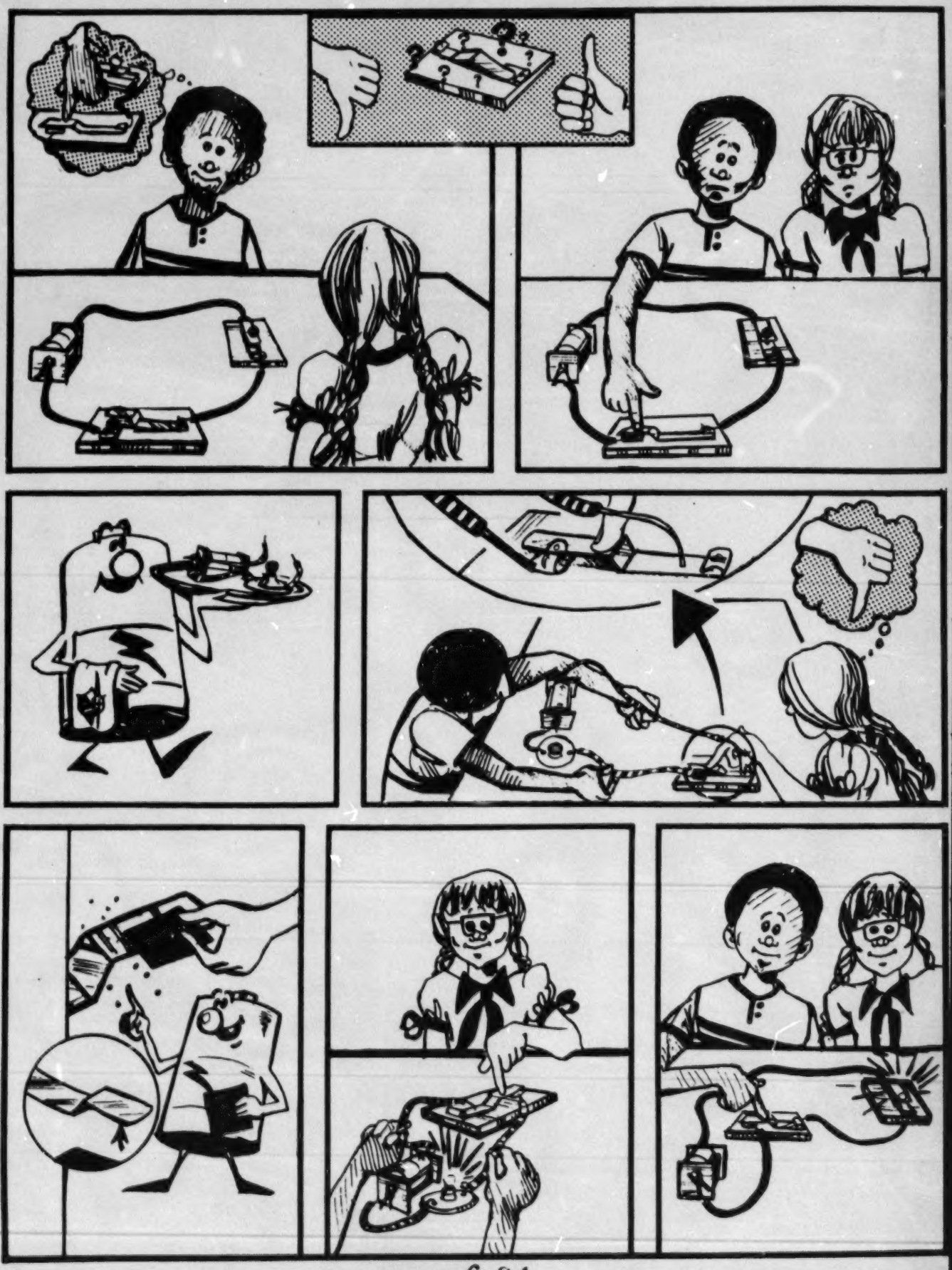
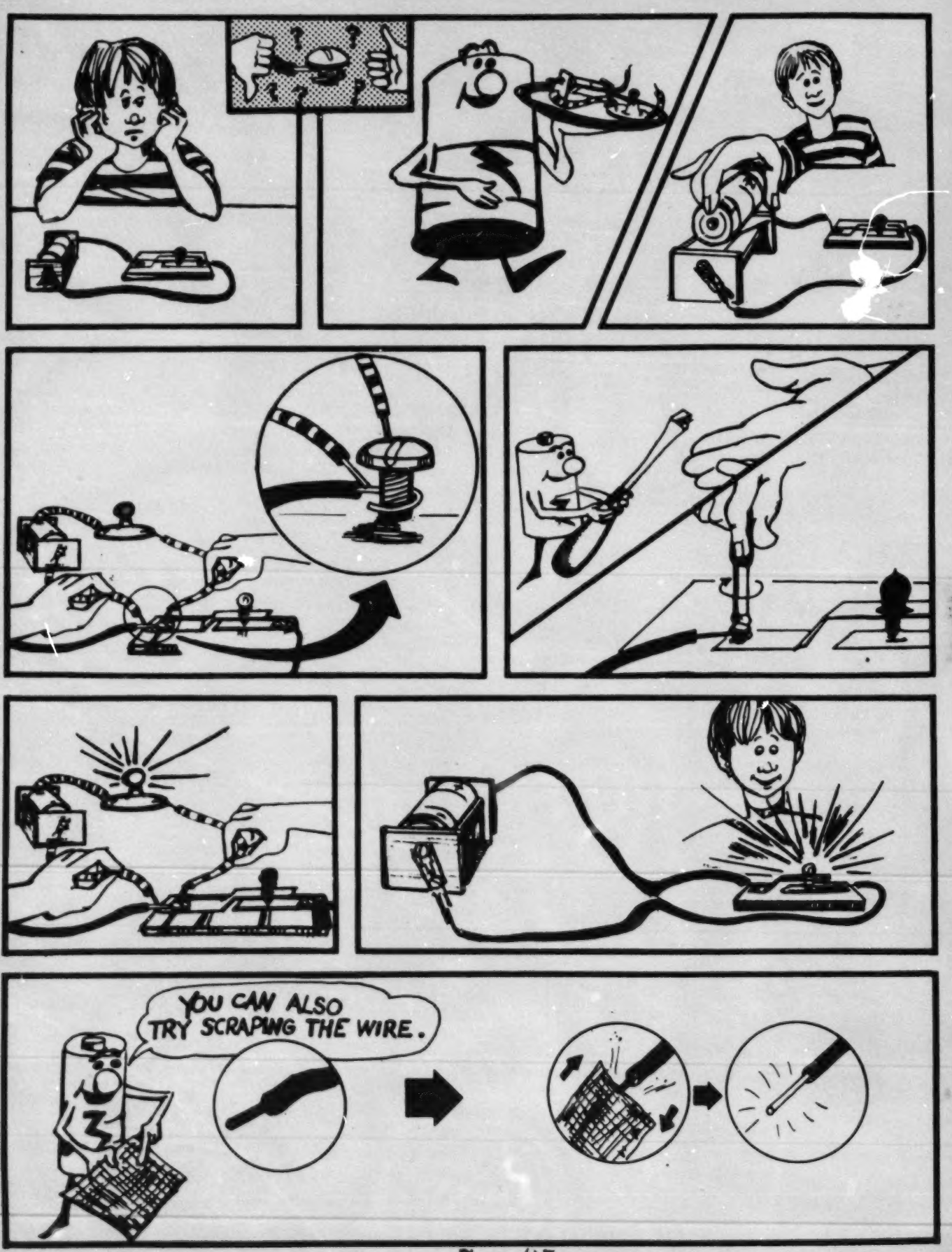

USE THIS CIRCUIT AS A BATTERY TESTER.
GOOD BATTERIES
TRASH

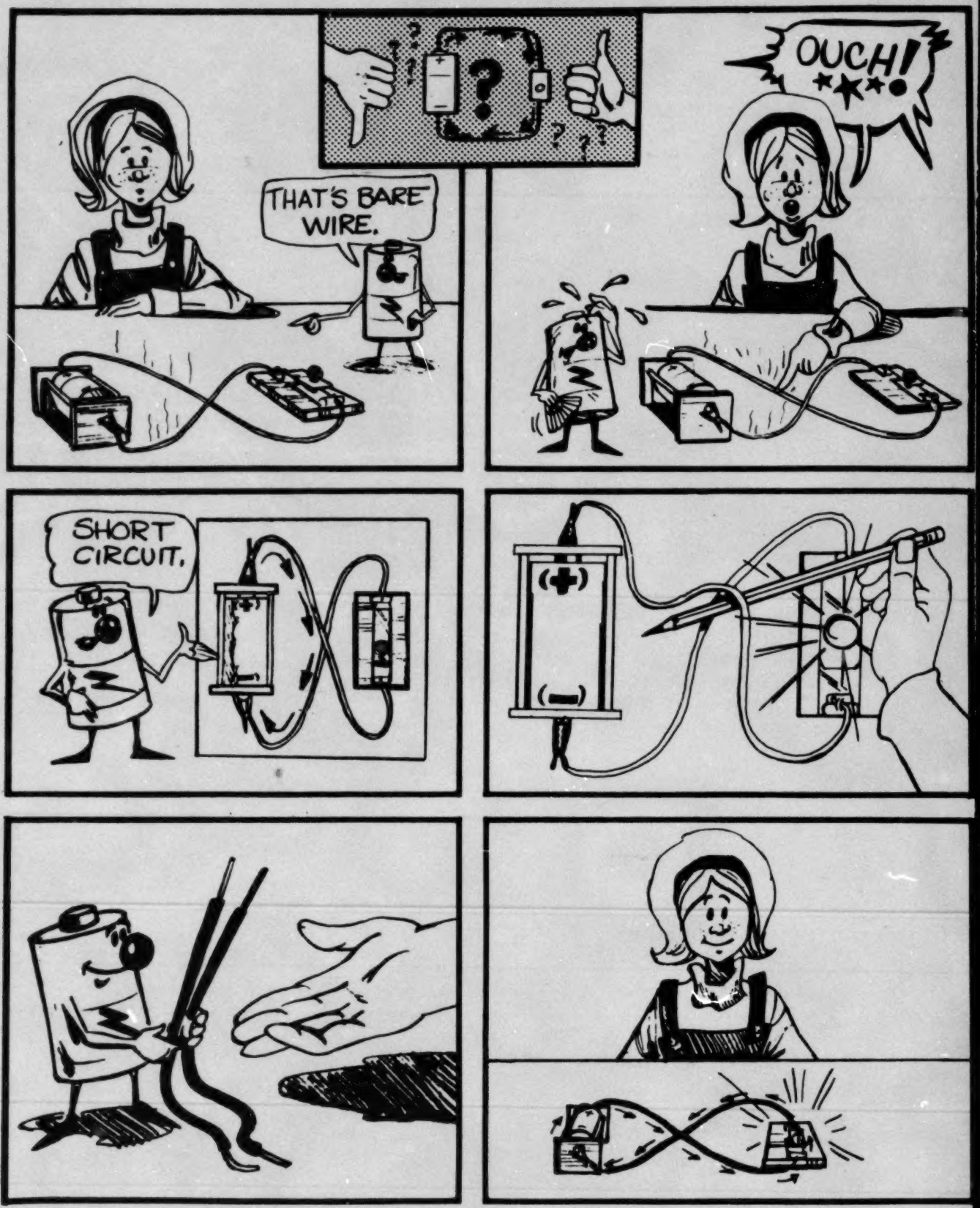

USE THIS CIRCUIT AS A BULB TESTER
GOOD BULBS
TRASH


HERE IS SOMETHING NEW.
USE THIS CIRCUIT AS A PATH TESTER.


TRASH




YOU CAN ALSO TRY SCRAPING THE WIRE.



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